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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

Buffalo Fly—Ministerial Announcement.

THE Minister for Agriculture and Stock, Mr. H. F. Walker, commented recently on a Ministerial statement in the House of Representatives, in regard to a plan drawn up by a conference of interested parties last year, and an assertion that the Queensland Government had failed to fall into line with the recommendations of that conference. Mr. Walker pointed out that, on the contrary, the recommendations made thereat were considered by him as the only practicable means available at that time for the prevention of the spread of the pest.

The resolutions adopted at the conference were agreed to unanimously, and the vital recommendations made were:—

"This conference would respectfully ask the Government of Queensland to cause an immediate inspection of the quarantine area to be made in order to determine whether there has been any extension of the infested area since last report; and, in the event of finding that no extension has taken place, that cattle remote from the infested area to the east and south should be permitted access to market after careful inspection.

"This conference is of opinion that, for the safety of Queensland and the Southern States, an effort should be made to push the fly-infested area back into Northern Australia before the more densely cattle-populated areas become infested. To this end it is recommended:—

(1) That a clean muster of the infested area in Queensland, and of Wollogorang and Calvert Hills in Northern Australia, should be made, and all cattle moved further into Northern Australia;

(2) That a buffer area, approximately 30 miles wide and kept free from cattle, should be established to the west of Wollogorang, and no cattle be allowed to cross such area.

"This conference is of opinion that the total cost of evacuation and fencing will not exceed £100,000, distributed over three years, and that approximately 50 per cent. of that cost will be recoverable from the sale of cattle evacuated."

There was no suggestion that the cost of the scheme would be apportioned on a fifty-fifty basis between the Commonwealth and Queensland Governments, as the finance was to be a matter for decision by the Governments concerned.

Queensland Government Action.

ON the first resolution, the Queensland Government took immediate action, and instructed its officers, who were already dealing with the problem in the area, to make a special survey of the country adjoining the known fly-infested area, with a view to determining whether there had been any extension. Subsequently, a letter, dated 11th June, 1930, was received from the Director-General of the Commonwealth Department of Health, advising that "the Commonwealth Government has given very careful consideration to the suggestions of the conference, but is unable to accept the scheme put forward."

Subsequent reports having revealed that the fly had extended a further 50 miles into Queensland territory, Mr. Walker stated that he again got into communication with the Federal Minister for Health with the view of concrete action being taken to prevent the further spread of the pest, and to eradicate it from present centres of infestation in Queensland. On the 20th November, 1930, Mr. Walker wired the Commonwealth Minister for Health as follows:—

> "Re buffalo fly. Authentically advised fly spreading alarmingly; imperative immediate steps be taken arrest rapid advance fly easterly and southerly beyond existing quarantine area, otherwise disaster Australian cattle industry positive (stop) Will you nominate convenient early date discuss this important national matter (stop)? I will meet you Canberra or elsewhere (stop) Understand Dr. Mackerras will report emphasising seriousness position and necessity for urgent effective action."

The suggestions for a conference at that time were unfortunately abortive. In February, 1931, while the Queensland Premier was in Canberra, he discussed the matter with the Federal Minister for Home Affairs, and Drs. Robertson and Tillyard. It was then decided that the first action to be taken was to make a survey to fix definitely the area of infestation, and the result of that survey would determine the action necessary to prevent any further spread. The survey was to commence about the beginning of April. The Commonwealth officers for the survey left Brisbane recently, a month late, although the Queensland officers detailed to assist in the survey have been on the spot during the whole season. On the question of funds, Mr. Moore intimated at this conference that the Queensland Government, while it was prepared to co-operate and help in every way to try and stop the threatened scourge, had no adequate funds, without the assistance of the Commonwealth, to erect fences and pay compensation for the compulsory evacuation of cattle from the infested areas. No offer, however, has ever been forthcoming that the Commonwealth would bear any definite share of the cost.

With regard to the statement that Queensland is the only State affected, the following extract from a letter, dated the 3rd April, 1931, from the Prime Minister, Mr. Scullin, provides a sufficient answer:—

"So far as the question of liability is concerned, the matter may be considered from three aspects—

(1) As an interstate-territorial matter, as between Queensland and the Commonwealth, as the authority controlling the Territory of North Australia;

(2) As an intra-State matter, so far as it affects Queensland itself;

(3) As a national matter, from the Commonwealth's point of view, as it concerns directly the States of Western Australia and Queensland and the Territory of North Australia, and indirectly the State of New South Wales."

There is no justification whatever for the reported statement that the Queensland Government would not accept any responsibility. At all times, Queensland has endeavoured over a period of many years to co-operate with the Commonwealth and get it to announce the basis on which it would contribute financial assistance. There is no scintilla of doubt that had the Commonwealth taken the action recommended in the first instance by the Queensland Government, the entry of the buffalo fly into Queensland could have been effectively prevented.

At the present time, Mr. Walker added, his own Department was taking every action possible to prevent the further spread of the fly. As a matter of fact, since March, 1929, no cattle whatever have been allowed to leave the infested and suspected area to enter any other portion of Queensland, and although it is recognised that this is not, or could not be expected to be, fully effective, still it has materially retarded the extension of the fly.

So keenly interested is Mr. Walker in the matter that he arranged to personally visit that portion of Queensland which is threatened by this menace, and is now in the Gulf Country carrying out investigations on the spot. This visit has no political significance whatever, and is purely in the interests of the cattle industry of Queensland and of Australia in general.

Control of Banana Thrips—£1,000 Reward Offered.

HIS Excellency the Governor in Council has approved of the issue of a Regulation, under the Fruit Marketing Organisation Acts, authorising the Committee of Direction of Fruit Marketing to offer a reward of £1,000 for an effective scheme of treatment for the control of banana thrips. The conditions are similar to those in connection with the reward for the control of beetle borer in bananas, an exception being that the members of the Banana Industry Protection Board will comprise the committee for adjudicating upon claims in connection with the reward.

In the event of the reward being paid, the Committee of Direction shall recoup such expenditure by a levy on Queensland banana-growers.

Certain conditions apply to an application for the reward; every applicant must agree to the Investigation Committee's interpretation of any of the conditions, and accept its decision as final. The scheme submitted shall be new, and must not be one which has previously been recommended by either the Department or Committee of Direction.

The claimant for the reward must produce satisfactory evidence that preliminary trials have yielded promising results, and must be prepared, at his own expense, to demonstrate his scheme of treatment in a series of field trials on an area approved by the Investigation Committee, and under the committee's supervision. The committee may take samples and submit same to a qualified chemist or analyst. The committee may also be supplied with sufficient material for further treatment on additional areas, and shall carry out such work, the cost of same being borne, in this instance, by the Committee of Direction. Field trials must be run for a period of six months.

The payment of the reward shall make the scheme of treatment approved the absolute property of the Committee of Direction. No reward shall be paid unless the Investigation Committee is convinced that the scheme is commercially practicable and will provide an effective control over the banana thrips, and be a decided advance over any scheme now available by the Department of Agriculture.

The claimant, when submitting his scheme, shall state in writing all details and all particulars required by the Committee of Direction. The Committee of Direction, at any time, may withdraw the offer, and it shall not be liable to pay the total reward to more than one person, although the reward may be divided between two or more claimants as the committee may decide. No proceedings shall be allowed against the Committee of Direction or the Investigation Committee in respect of any injury or loss sustained by the claimant.

Australian Butter in London.

"AUSTRALIAN butter was never so high in public favour before. The Queensland factories are outstanding. The extraordinary thing is that all Australian butter so far has been sold, but New Zealand butter at the same prices as Australian has not had so ready a sale, and there are almost 200,000 boxes of New Zealand butter remaining in cold stores unsold. So their butter is not so popular as formerly.

"The fact is the public are now waking up to the fact that the best brands of Australian butter have really a better flavour than that from New Zealand."

The foregoing comment on the quality of Australian butter reaching the London market is taken from a letter from an English correspondent to Mr. W. T. Harris, Secretary of the Queensland Co-operative Dairy Companies' Association. It makes very gratifying reading for Queensland dairy farmers.

THE QUEENSLAND SUGAR INDUSTRY.

By H. T. EASTERBY, Director, Bureau of Sugar Experiment Stations.

PART XV.

(c) Mills and Milling Work (*Continued*).

BEFORE leaving the subject of the early sugar mills, it may be stated that a Royal Commission was appointed late in 1888 to inquire into the general condition of the sugar industry in Queensland, and to report upon the causes which led to the then languishing condition of the industry throughout the Colony, and the best means to be adopted for reviving and maintaining its prosperity. This Commission, which consisted of W. H. Groom, M.L.A. (chairman), and Messrs. King and Cowley, commenced its duties in January, 1889, and presented voluminous reports in April of the same year. The majority report was signed by Messrs. King and Cowley, while the chairman signed a separate report. This Commission will be referred to in a later article, meantime only matters in relation to sugar mills will be dealt with, and from the evidence presented a very dismal picture of the cane industry at this time was painted by the witnesses.

Port Douglas.

The Commission commenced taking evidence at Port Douglas, in which district at that time many tropical products were being tried, including citrus fruit, coffee, and also some cane which was sent to a Cairns Mill and the Bloomfield Mill for plants. Mr. J. D. Johnstone, an old Mossman identity, stated he was clearing his land for sugar growing, as his brother Mr. W. Johnstone intended to start a mill at Mossman. This, however, never took place. At that time the Brie Brie sugar plantation was in liquidation, the owner was stated to be insolvent and the kanakas had not been paid.

Cairns.

Pyramid plantation at Cairns, which was next visited, was in the hands of the bank, but was still operating. The manager, Mr. Langdon, considered that £130,000 had been expended on the mill land and plant, and there were some 670 acres under cane. There were 212 kanakas, 24 Japanese, and 60 Europeans employed during the crushing. Mechanics got £2 10s. a week with rations and lodgings, and bullock-drivers and draymen got from £1 15s. to £2 per week with rations and lodgings. The estate was not paying its way. The depression in the industry was caused by the labour question and the low price of sugar. Grubs gave them a lot of trouble. Most of the machinery was made in England, but a set of clarifiers had been made by Walkers Limited, Maryborough.

At Hambledon there were 6,000 acres in the estate; 900 of which were under cultivation, producing in 1888, 1,100 tons of sugar. Most of that sugar was sent to Melbourne. About £180,000 was invested, but no return on interest had been received. The annual expenditure was some £23,500. The lowest rate of wages paid to white men was £2 2s. a week, the men keeping themselves. Chinese were paid £1 5s. a week and find themselves. Kanakas' wages varied from £6 to £8 a

year. All the ploughing was done by white men. There was about £33,000 worth of machinery in their mill; of that £8,000 was for colonial machinery made by Walkers Limited, and also at Mackay and Townsville. Their trouble mainly was the competition with bounty-fed sugars. It took about 12 tons of cane to make 1 ton of sugar in 1888, but the mill had made it for less than that. One of the Swallow family at Hambledon said, "I look on the fruit trade as being the great trade up here, better than sugar." At that time there was a large quantity of bananas being grown, and rice was also grown at Cairns.

The late Archie Meston and others proposed to put up a mill at Freshwater, about 1881, but owing to the dread amongst sugar planters that kanaka labour would be abolished suddenly, they countermanded the order for mill machinery.

Andrew Leon, a native of China, said he had been in the Cairns district since 1875 and was the first man to take up a selection. This was 3 miles from Cairns and known as Hop Wah. They started to grow sugar-cane after trying cotton. The cane grew well, but the crop did not turn out well. They employed Chinese labour at about £40 to £60 a year, with rations. The plantation did not pay and they had to sell it and made a loss of some £29,000.

Messrs. Draper, McKnight, and Hobson, who purchased the Hop Wah plantation from Leon also stated they lost money for want of adequate labour. The machinery was of good description; they had a vacuum pan and one set of rollers; the sugar produced was of good quality.

Innisfail.

The Commission next sat at Innisfail. Giving evidence, the manager of the Innisfail Mill and plantation said they had 400 acres under cultivation. About £36,000 had been invested in the mill and plantation, which was solely Mr. Fitzgerald's investment. There was a mortgage on it, and the mortgagee, Miss O'Reilly, had taken the place over. He found Europeans were not much good at field work; they were no good with the hoe. They would do ploughing and following horses, but nothing else. They worked as well at that as the men on the Downs, but they could not stand hoeing. He never saw a white man who would continue to work on a canefield. He considered the kanaka did best in the cane, but they could not get enough labour; they were just keeping themselves since Miss O'Reilly took the mill over. The estate was just paying its way, but no interest on the debt. That was dead capital gone. The value of the plantation land was £7 an acre. (*Note this valuation of some of the finest land in Innisfail worth to-day from* £70 *to* £100 *an acre for sugar-growing.*) The manager employed ploughmen at £1 per week and tucker, and they would have to be very good at that. The labour question and the low price of sugar were the greatest drawbacks. Mr. C. Nolan bought the crop one year, and he tried to work it with white labour only, and he said he lost between £500 and £600 for three months' crushing. He bought the cane as a speculation, but had no knowledge of the business.

Mr. G. E. Adams, manager of the Goondi Plantation and Mill, owned by the Colonial Sugar Refining Company, stated that the total area of Goondi was 12,500 acres, and 2,300 acres were under cane. During the previous year (1888) the cane from 1,127 acres had been crushed, and they expected to take cane from 2,090 acres during the

current season. About 2,400 tons of sugar were made in 1888. In that year, 120 Europeans, 271 kanakas, and 44 Chinese, were employed. Some of the land was leased to Chinamen. Double crushing and maceration were used in the mill, and there was a triple effet and a vacuum pan. The mill machinery was made in England and Scotland, and *he was happy to say none of it was Colonial made!* Only whites were employed in the mill. The employment of aboriginals was not a success, as if they employed one he generally brought all his relations with him. Asked what effect the shutting out of the kanaka in 1890 (as was then proposed) would have, the witness said he expected he would have to shut up. White labour would not do in the fields.

Mourilyan was the next mill visited. At that place Mr. R. Smellie, who was one of the partners in the Mourilyan Sugar Company, gave evidence. He said the profit had been almost nil in working the plantation, and the proprietors had not withdrawn a single shilling for salary or anything else; they lived on their means. There were 5,000 acres, 1,200 were cleared and about 850 under cane. In 1886, they made 2,000 tons of sugar, 1888 about 1,000, and the present year (1889) they expected to make 1,000 tons—this was in consequence of the drought. Over £120,000 had been expended. Sugar had fallen 50 per cent. in price since 1884. It took from £1,000 to £1,200 a month to work the plantation. They employed Javanese and kanakas in the field, and about 25 Europeans in the mill during crushing. A rather interesting light was thrown by the witness on the subject of non-British but European labour, which the manager tried to get in 1885 when the Queensland Parliament passed an Act to enable employees to introduce labour from the continent of Europe. When the Act became law he arranged with his agent in London to go over to the Continent and send out forty men. When the agent got to the Continent he found that the Continental powers would not permit the Act to be put into operation. He subsequently obtained thirty labourers from England at £30 to £40 a year, but they were not successful at mill work and made many serious mistakes. They did not appear to want to work and they finally only kept one of the lot. It was their intention to have worked the plantation by white labour; this was the start of it and this was how they were treated. If a white man was asked to work in the field then he used to ask if he were a kanaka. The mill had a double crushing plant and maceration was used. They burnt wood and megass, but no coal; they had tramlines and two locomotives, and the machinery was of the very highest class at the time. They got 1 ton of sugar from 10 tons of cane in 1888. It was estimated they lost 6 per cent. saccharine matter in the bagasse, equal to 2 per cent. of the cane. No more complete plant existed than the Mourilyan plant. It had every appliance. Aboriginal labour was not reliable. The heat was such that a white man could not work in it—that is, during the summer. The depressed state of the sugar industry was caused by the low price of sugar owing to over-production, and that over-production was stimulated by the bounties to beetroot sugar. Another great cause was the uncertainty of labour. If they could employ more kanakas they could extend their operations. A plantation is the same as any other commercial industry. A small mill will not pay. Take the Mourilyan Mill; it could produce 15 tons of sugar per diem. He could put up another mill and produce 30 tons a day with no more expense than the product of the one mill. It takes just the same time to boil a pan of 5 tons as it does to boil one of 20 tons. The sugar

industry would flourish in Queensland when a number of small plantations joined together and amalgamated. At the Mourilyan Mill they used the Despessies process in the manufacture of sugar. They used sulphur and superphosphate. The witness went on to give the following outline of the process of the manufacture of sugar, at that time in use at the Mourilyan Mill, which at present should be interesting for many reasons. It will be seen therefrom that white sugar was made direct for the market:—

"The juice, as it flows from the crushing mills, is received in a cistern where it undergoes the first stage of the process called the sulphuring. Our clarifiers are each of a capacity of 800 gallons, and for this quantity of juice, of a fair quality, we use from 2½ to 3 lb. of roll sulphur, which is burned in a small furnace and the fumes therefrom are forced through the juice by means of an injector and jet of steam. The action of this sulphurous acid disengages a considerable quantity of impurities from the juice, and leaves it purer, and in a manner bleached, and considerably acid to the litmus paper test. This acidity is rapidly destroyed by adding milk of lime till the juice becomes neutral. As a matter of practice we usually add this lime gradually as the clarifier is being filled. The juice is then brought to the boiling point, and superphosphate or Ehrmannite, containing from 40 to 50 per cent. of free phosphoric acid, is then added in quantity (usually from 2 to 3 lb. for ordinary cane juice) in order to bring the liquor back to the natural acidity of the juice as it exists in the cane; this acidity is again destroyed by the addition of a little more milk of lime. And at this stage samples are always taken in a test-glass for careful examination. The litmus paper should show the juice to be *about* neutral. If the impurities appear, in the test glass, to precipitate rapidly in *large* flocules to the bottom of the glass, leaving the juice bright and clear, like pale sherry wine, above, the defecation may be considered complete, and it is then run down to the subsider. Every care ought to be taken at the clarifiers to have the juice thoroughly defecated, as any defect here cannot be afterwards rectified in most mills; but in mills supplied with filters the syrup can again be re-treated and any mistake at the clarifiers thoroughly rectified. In examining the sample in the test-glass, if the impurities are in very small flocules, merely black specks continually revolving in the liquor, and apparently unable to precipitate, it is a pretty sure indication that a *little* more lime should be added; but added in small quantities with care. The liquor remains in the subsiders as long as the requirements of the after-process will permit, in order that all the disengaged impurities may precipitate. The clear juice is then drawn off to the apparatus called the triple effet, where it is evaporated in vacuum at low temperatures to a density of 23 B. The syrup, at a temperature of 140 deg. Fahr., is then discharged into what is technically called the re-heating tank. Here the syrup is brought up to the boiling point, for the purpose of coagulating the albumen, and disengaging it from the syrup, and thus assisting the syrup to filter more freely through the filter bags. At this stage we always add to the syrup a little superphosphate and neutralize with milk of lime, leaving it nearly neutral, but rather to the acid side than otherwise. The syrup here should be bright, clear, and sparkling. It is then run into Taylor's filter bags, where the albumen and other impurities in the syrup are extracted. It is then boiled in vacuum pans in the usual way, and as massecuite is discharged into a receiver and mixer situated just above the centrifugals, and is dried while still

hot. The sugar, on being discharged from the centrifugals, is passed through a drier, from which it is bagged direct, and is now ready for market. This is the whole process without interruption, but there are a great many most important details which will show on the debit or credit side of profit and loss according to the care with which they are attended to and carried out. To go back to the subsiders, when the clear juice is withdrawn from these, there remains about 70 gallons of juice containing the lime, superphosphate as used in clarification, and the impurities of the subsidence. This is run down to tanks, where it is brought to the boiling point, and by means of a mont-jus with a steam pressure of 70 lb. to the square inch is forced through the filter presses, where the clear juice is disengaged, leaving in the presses all the impurities in dry solid cakes. These cakes, by this process, are very valuable as a manure. It will be noted that if these presses are not worked with extreme care, and under constant supervision, ignorant and careless men may cause considerable loss, and mill managers cannot be too careful in having all their connections fixed in such a manner that waste in this quarter should be easily detected. Superphosphate should always be added first and neutralised with lime—if the lime be added first it tends to colour the juice, which no after process can rectify. There has been considerable discussion in some quarters about the benefits or otherwise in the use of sulphur, and in 1886 I had a communication from a home firm requesting me to put the question to the test and report my experience. From close attention to the mill work night and day for six months I was perfectly satisfied that the use of sulphurous acid did increase the quantity of crystallizable sugar, and so reported then, which was adverse to the opinion of an old refiner. For the last two years I devoted my whole attention to the mill work in its every detail, and am still of the same opinion. I may here add that the report of the Commissioners of the Agricultural Department of the United States, who have been engaged for three years practically testing the manufacture of sugar by the diffusion process, has just been published, in which they announce the fact that the use of sulphurous acid does increase the quantity of crystallizable sugar extracted from the cane. This company has also a complete charcoal plant, but for many reasons I prefer the Despessies process as carried out by us and described above. It is more rapid, we get a better defecation, less liable to waste, and no sweet waters to evaporate. The chief use of filtering syrup through animal charcoal is to decolorize it, but if this colour is caused by material impurities held in solution, it has no power to do so, and hence defecation must be very perfect in order that the full benefit of charcoal may be obtained. This is very difficult by the ordinary lime process in so general use, and the only process I know of to attain this object is to largely overlime the juice, and to discharge it with carbonic acid."

In concluding his evidence Mr. Smellie said he believed the sugar industry was the greatest industry in Queensland not excepting gold, tin, copper, or any other minerals, or even squatting. If it were flourishing he believed that they could export from Queensland over £10,000,000 worth of sugar, &c., per annum. Hitherto it had received no encouragement, the planter and all his operations had been looked on as if he were an enemy to the country. These roseate dreams of a £10,000,000 export have not been realised, but Mr. Smellie was one of the first to recognise the potentialities of the Johnstone River district in the possession of rich river banks and scrubs.

The next mill visited was the Queensland Sugar Company's plantation "Innishowen," of which Mr. W. Canny was then manager. There were about 3,840 acres of which 600 were under cultivation. They had crushed the cane from 400 acres during the last season and made 300 tons of sugar. £80,000 was invested in the estate, but the plantation did not pay interest on its outlay and the working expenses. The annual working expenditure was between £7,000 and £8,000. They employed kanakas, Malays, Chinese, and Europeans. During the crushing they had Chinese to whom they paid £1 8s. a week for cane cutting, and they had from fifteen to twenty Europeans. The engineer got £4 a week, the sugar boiler £3 a week, and a second sugar boiler £2 10s. a week, carpenter £2, baker £2, and blacksmith £2 10s. per week, and the overseers about £80 a year. All these men got rations and quarters; where married they got double rations. There was a general disinclination amongst white men to do trashing or field work except ploughing. The machinery they had in the mill was crushing plant, triple effet, vacuum pan and centrifugals made by the Fives-Lille Company in France. No Colonial made machinery was used. The average cost of overhauling French machinery was more than English. The climate was more trying than Maryborough. The contractor doing work for the Divisional Board wrote the witness as chairman that he had to stop all Board contracts on hand as none of his men could stand the heat; this was in December. The average yield per acre was from 20 to 26 tons of cane. They suffered from scarcity of labour and the cane grub. The low price of sugar had something to do with the depressed state of the industry, and he did not think they would ever have the high price for sugar again. Asked what the effect would be if the kanakas were abolished in 1890, witness said it would mean the closing up of the plantation, it would be impossible for them to employ European labour except at a cost of many thousands per annum. He would not recommend the employment of the kanaka if he thought white men could do field work; white men were all right in the mill.

Herbert River.

The Commission then moved on to the Herbert River where Mr. F. Neame of the Macknade Plantation gave evidence. He stated the total area of the plantation was 6,856 acres, 690 being under cane. In 1888, they crushed cane from 500 acres and made 725 tons of sugar and about 25,000 gallons of molasses. Most of the latter went to waste but some was used for manure. The Macknade Sugar Company had about £135,000 invested, and they had spent another £18,000 since his firm had taken it over and it was worked at a loss. It did not pay interest on the expenditure. The annual expenditure was some £15,000. They employed about 30 Europeans, 20 Chinese, 90 kanakas, and 73 Malays. Europeans got on an average £80 a year, Chinese 16s. a week, kanakas £8 13s. 6d. a year, and Malays £1 9s. 2d. a month, rations being supplied in all cases. He had never employed Europeans on field work outside ploughing, and never found such labour willing to take same. In the mill one engineer was paid £200 a year, and the other £3 a week, everything found. It took about 10 tons of cane to make a ton of sugar. They had double crushing and all labour-saving appliances, and they macerated. The capacity of the mill was some 150 tons per day. They at one time had sold the mill but the purchaser made a loss of about £20,000 a year, and the present firm of Neame Brothers had to take it back.

The Ripple Creek Mill was next visited and one of the partners, Mr. R. M. Boyd, gave evidence. The area of the plantation was 1,650 acres, 800 of which were under cultivation. The previous year they had crushed 620 acres of cane, and had made 1,025 tons of sugar and 38,000 gallons of molasses, which was thrown away. £85,000 was invested in the estate, but nothing was returned by way of interest. The machinery cost £30,000 and had been manufactured in Glasgow. He had personal knowledge of one plantation on the Herbert that had lost £100,000. It had been offered to him for £20,000. Hamleigh Plantation also had lost about the same amount and was sold for £12,500.

Gairloch Mill was the next on the list and Mr. L. G. Cowley examined. He said Fanning Nankivell and Company were the original owners. The machinery now in the mill cost about £40,000 and the total area of the estate was about 4,600 acres, of which 1,200 were under cane. The mill never exceeded an output of 900 tons of sugar, but if kept going regularly it could turn out 2,000 tons per season. He thought Fanning Nankivell invested £120,000, but the plantation did not pay working expenses and they disposed of it. It was offered by auction in Melbourne but they could not sell it. Afterwards they got about £21,000 selling to different people. Five hundred acres were sold to Boyd; horses, plant, and tools to the Colonial Sugar Refining Company; and land and buildings to another company. It was owing principally to the difficulty in getting reliable labour that the plantation did not pay, also to the low price of sugar, but if there was reliable and cheap labour it could be made to pay. He considered kanaka labour the best for cane. He believed the white man was physically capable of working in the cane, but they required such high wages that planters could not afford to pay them.

The Commission then proceeded to Hamleigh Plantation and Mill and called Robert Grierson Blackmore, the manager of the estate. He stated that the former owners were Hamleigh Sugar Company, but it was now owned by Whittingham Brothers, of Melbourne. The extent of the estate was 4,700 acres, of which 500 were under cane. There were 1,500 acres of good cultivable land. They did not crush in 1888, as they were unable to do any planting and could not get a crop in. They hoped to have a crop the next season. Originally £120,000 had been invested, but Whittingham Brothers only gave £13,000. The property was sold by public auction, and £13,000 was the highest bid for it. Europeans, Javanese, and Chinese were employed, as well as Polynesians. He did not think they could improve on the kanaka for cane cultivation; he had never been able to get Europeans to even think of hoeing and trashing. The value of the mill and buildings was between £30,000 and £40,000. Practically all the machinery had been made in Europe, though there was some locally-made stuff amongst it. The machinery was the best that could be got for the money. The mill could turn out some 2,000 tons of sugar per annum. The witness agreed that the chief cause of the depression in the industry was lack of reliable labour and the low price of sugar. He did not favour Chinese labour; they were not desirable and of no benefit to the country, and they impoverished the district by taking all the money they earned out of it.

At the Victoria Plantation, the property of the Colonial Sugar Refining Company, Mr. Wm. McLean, acting manager, said the area of

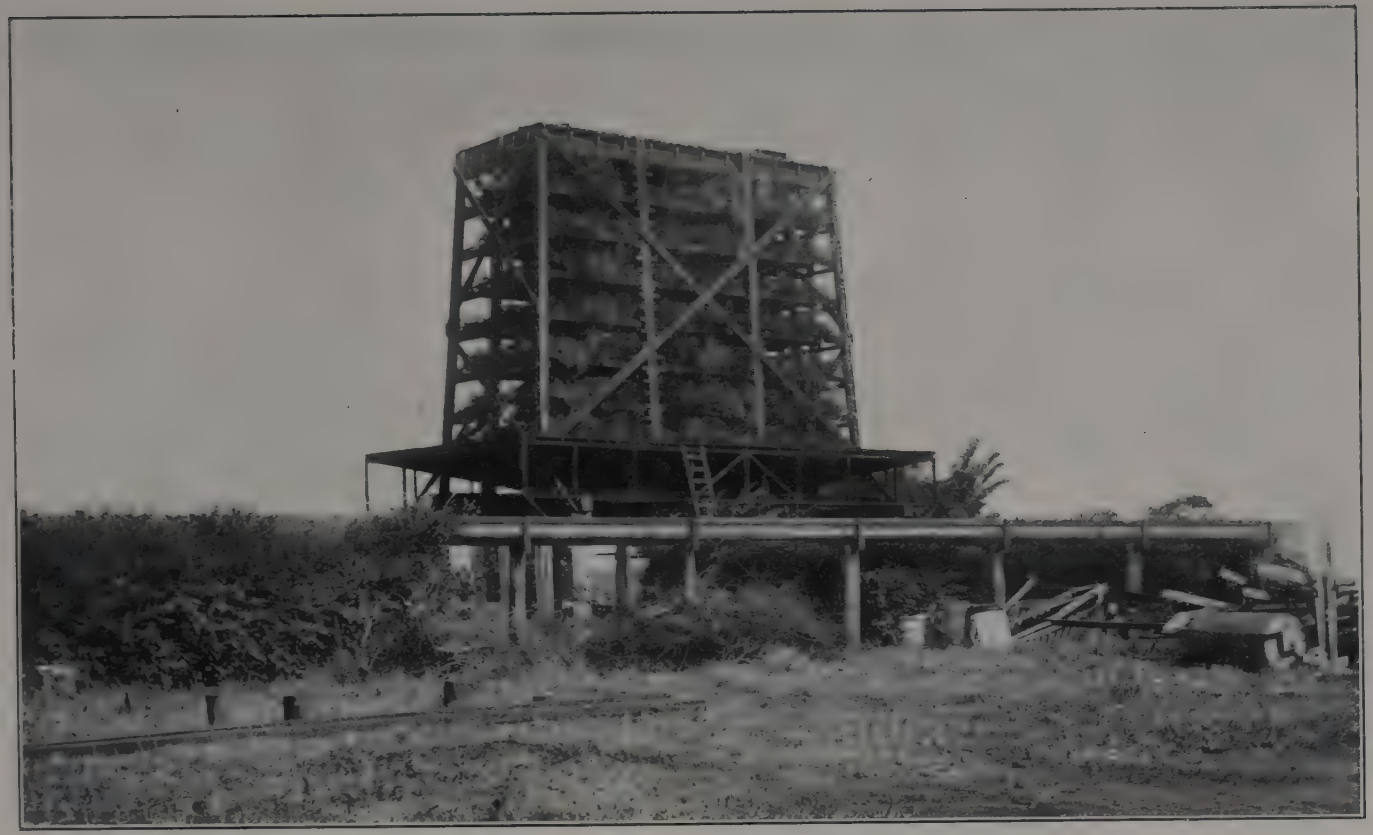


PLATE 94.—REFRIGERATOR OR COOLER IN ONE OF THE OLDER MILLS.

This is for using water over and over again. The condensed water is pumped to the top, falls through the various platforms of twigs, &c., into a reservoir below, and is then pumped back into the mill. These coolers are used in districts where the water-supply is scanty.

the plantation was about 20,000 acres, and between 2,000 and 3,000 acres were being cultivated. Molasses was a waste product. They paid ploughmen £1 a week, mill hands from £1 to £3 a week, engineers £3 10s. to £4 10s., all with rations and quarters. The whole of the land was under cultivation by implements. They had double crushing in the mill, macerated, and employed chemists. The company had 18 miles of permanent tramline worked by locomotives.

Lower Burdekin.

The Commission next visited the Lower Burdekin district and examined Mr. Charles Young, of the Kalamia Plantation, who said the estate comprised 7,000 acres. In the preceding year (1888) they had crushed cane from 300 acres, and had made 140 tons of sugar. The amount of capital invested was £90,000. It returned no interest, and last year there had been a heavy loss. The mill cost about £20,000, and the annual overhaul a little over £200. They used irrigation costing about 7s. 6d. per acre, and had any quantity of water. The reason they had such a poor crop in 1888 was that they had a very heavy crushing in 1887 and could not get labour to take it off and cultivate the land for the next season. He was of opinion that if they could not get kanakas after 1890 the industry would have to close up. He and his brother managed the estate; they were not the owners—they once were. They did not have double crushing, but they had vacuum pans, triple effets, and filter presses. It took from 1,500 to 1,700 gallons of juice to make 1 ton of the best white sugar. The mill had a capacity of 1,500 tons and they had made one year about 1,350 tons. They could not afford to trash the cane, but burnt it sometimes, which was a very dangerous process and they had some nasty fires.

The next mill taken was the Airdmillan Estate, of which Mr. Archibald Campbell McMillan was formerly local director and manager. The total area was 15,000 acres, of which 1,500 acres were once under cultivation. About £200,000 had been invested, but never at any time had it returned any interest, and the mill had been closed down in 1886 and the whole of the land thrown out. The cause was that the English shareholders were satisfied that the Legislature of the country was against the industry and would go no further with it. If the kanakas were abolished in 1890 the industry would shut up.

Mr. James MacKenzie was the next witness and said he had established the estate known as "Seaforth," but he was not owner now—only manager. There were some 2,500 acres in the plantation, of which 800 were under cultivation, 570 being at present under cane. Only 250 acres were crushed last season (1888), and 250 tons of sugar made. From £85,000 to £90,000 had been invested in the property, but he had never had any return from the capital invested nor did the estate pay working expenses, and practically all the capital he had invested was gone. He had once employed a white man (who was hard up) at cane-cutting. He kept up at cane-cutting with the kanaka for a day, but the next day he disappeared. One season he had an Italian, who stuck to it the whole season, and these were the only instances he had known of white labour. Kanakas were the best field labourers. His mill had cost £22,000 erected, and the annual overhaul £300 to £350. The expenses in 1887 were a little over £15,000 and they made 1,760 tons of sugar. They used irrigation, but could not

irrigate last year owing to the heavy crop and insufficient labour. If they had been able to cultivate and irrigate they would have had a much better crop. They were using filter-press cake for fertiliser. He considered the plantations were conducted more economically than formerly, and more sugar was extracted, and there were more labour-saving appliances, and things were more carefully looked after.

The next mill was Pioneer. The late John Drysdale gave evidence that he was the manager for Drysdale Brothers, but was not a member of the firm. Four of his brothers were in it, and one or two others. It was a sort of private company. The total area of the estate was 5,800 acres, of which 1,270 acres were under cane. The cane from 800 acres was crushed in 1888 and 650 tons of sugar were made. They did not measure the molasses but ran it away down a drain. In 1887 they had made 2,550 tons, as 1887 was a very good year. He put the deficiency down entirely to the drought. The capital account stood at £96,000. There was a profit and loss account of £12,000 to the bad and a loss of interest on £50,000 for six years—that is, they had made no interest and had lost £12,000. The working expenses for 1888 were £16,145. They employed 40 Europeans, 8 Chinese, 7 Cingalese, and 244 kanakas. The estate practised irrigation and their main pumping station raised 4,000,000 gallons per day of twenty-four hours, which would irrigate from 16 to 20 acres. Each flooding cost 5s. per acre, not including interest on capital or wear and tear of machinery. It certainly paid to irrigate, and they were extending their operations, which would bring 150 acres more under the system. The cost of the machinery in the mill was estimated at £30,000, and the annual overhaul about £400. They had to get their sugar to Townsville by bullock waggons and steamers. It was most unsatisfactory; the steamers were too uncertain and the arrivals and departures were entirely dependent on the tides. Railway communication would be a great improvement. Another witness questioned as to white labour said he would never think of trying it. Even if sugar were at a high price and they could afford to employ Europeans, his experience led him to say they would not do the work.

[TO BE CONTINUED].

FACTORS IN SOIL FERTILITY.

Valuable as they are, there are limitations to what fertilizers can accomplish. Want of plant-food is, of course, a common cause of infertility, especially in the case of land which has been exhausted by repeated croppings without manuring or rotation. Proper manuring, giving due consideration to the requirements both of the soil and of the crop, is the remedy, provided that the land is in good condition; but the important fact must not be lost sight of that the mere addition of plant-food is not sufficient unless the soil is in such mechanical condition that it can make good use of the manure applied.

Deficiency in humus is a common cause of infertility. A soil deficient or wanting in humus is less able to withstand droughty conditions, lacks cohesion, and is easily blown or washed away, and is unfavourable to the growth of micro-organisms.

Absence of bacteria, particularly of the nitrifying organisms, is prejudicial to the satisfactory production of crops. The cause is generally want of aeration, lack of lime or vegetable matter, sourness, bad tillage or drainage, &c., and when such soils are restored to good condition the development of the nitrifying organisms will proceed normally.

Manuring alone is not likely to be of any benefit on land that is badly drained, sour, or in bad tilth.

Bureau of Sugar Experiment Stations.

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following entomological advice from the Northern Entomologist, Mr. E. Jarvis:—

Cane Grubs at Their Worst.

During this month fully-grown grubs of our "greyback" cane beetle will be found commonly on infested areas, on which they will have either so damaged the stools as to cause them to fall over in places, or levelled considerable areas of cane by devouring all the roots and portions of the basal ends of the sticks. It is now too late to practise remedial measures, seeing that most of the damage has been done, and the grubs are beginning to think about tunnelling downwards in order to construct earthen chambers in which to transform into the pupal or chrysalis condition. If desired, these pupæ can be destroyed later on by fumigating the ground with carbon bisulphide at any time during July to October; most growers, however, preferring to leave the beetles to ultimately emerge from such infested land in November or December, in the hope that when doing so they will wing their way to other fields in which to deposit their eggs. It is well to remember, however, that should numerous feeding-trees of this insect happen to be situated within half a mile or so to the north-west of such pupæ-infested land, the beetles arising from it may migrate to these trees and after feeding there for a couple of weeks perhaps return and lay their eggs in the vicinity of the land which gave them birth.

Be Prepared to Fight Leaf-eating Caterpillars.

Keep a lookout for the appearance of caterpillars of the army worm and other noctuid moths, which during this month may invade canefields and attack the leaves. Such larvæ are best combated by the use of poison sprays, arsenate of lead having proved to be the cheapest and most effective for this purpose.

Caterpillars of our common army worm (*Cirphis unipuncta* Haw.) attain a length of about 1½ inch and can be easily distinguished by being striped lengthwise, the colour varying from light greenish-yellow to greenish-black. Three distinct lines occur on each side, the middle stripe being nearly black, while the lowest one is usually light greenish or pale yellow. The head is greenish-brown mottled with blackish. These caterpillars generally conceal themselves by day amongst the unfolding heart-leaves of cane, seldom moving forward in army formation unless in search of fresh food.

Ordinary invasions of this pest from grass land adjoining a canefield are effectively controlled by spraying the cane leaves with lead arsenate, in such manner as to form a poisoned strip or band about 20 feet wide immediately in front of the line of advance being taken up by the caterpillars. In cases where such invasion has remained unnoticed, and the caterpillars have already become established throughout a block of cane, those portions appearing to be the most seriously affected should be sprayed first. Use 2 to 3 lb. of lead arsenate in about 50 gallons of water, taking care to keep the mixture well agitated whilst spraying it over the leaves, in order to ensure and maintain uniform suspension of this arsenical in the water.

What Spray Pump to Use.

The kind of pump to select will depend very largely on the size of the farm. On small holdings the "Vermorel Bucket Pump No. 10" will be found suitable for many purposes other than the spraying of cane stools.

The foot rest can be adjusted to suit any size bucket, petrol tin, &c., and being fitted with a large compression chamber and automatic agitator a powerful and continuous spray is ensured, as well as a uniform application of any arsenicals used. The price of this pump is under £2. For larger cane farms the "Presto" spray pump would probably meet requirements in many cases. This is mounted on a wheel and fitted with push handles, three strainers, agitator, self clearing swivel nozzle, and large compression cylinder. One with a 6 gallon capacity costs £6 10s.; that holding 11 gallons, £7 10s.

Either of the above spray pumps may be seen in action at any time at the Meringa Experiment Station.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following notes on the biological control of insect pests from the Entomologist at Meringa, Mr. E. Jarvis:—

Attempts to control grasshoppers biologically have, up to the present, proved unsuccessful. An effort was made in 1914 to destroy locusts injuring sugar-cane in Reunion by introducing the disease *Mucor exitiosus* Mass. Bordage tells us, with regard to this attempt, "In the laboratory the result was very satisfactory, as it was there possible to maintain the temperature and moisture conditions most favourable to the propagation of the fungus; but in the field the same success was not met with." This has been the experience elsewhere, both in Queensland and other countries, when seeking to employ such a control method against insect pests. The Metarrhizium fungus, for instance, destroys a certain percentage of grubs of our "grey-back" cane-beetle each season during autumn months, this being the time of year when the moisture and soil temperature happen to be favourable to spore germination. Attempts made by us here to utilise this disease at any other time of year have never proved satisfactory.

Again, Beltran remarks, in connection with attempts to employ *Coccobacillus acridiorum* against grasshoppers: "It is pathogenic under certain conditions only, especially during rainy weather, natural spread of infection being very low and unimportant. Fatal effects can be obtained by injections of a culture into the body of the locusts, but not by feeding them on plants sprayed with a culture, and the disease appears to be of no value for their control."

In recent years such experiments have not met with success in the field, and the fight against locusts at the present time is being effected by the following methods:—

1. Spraying;
2. Dusting from aeroplanes;
3. Rolling;
4. Poison baits;
5. Barriers;
6. Burning;
7. Flooding eggeries;
8. Harrowing eggeries;
9. Driving into ditches;
10. Burning;
11. Collecting by mechanical means, &c.

Similarly, we are aware that experimentation carried out since the year 1878 —when Metchnikoff first tried to utilise fungoid and bacterial diseases against injurious insects—has not led to the discovery of any disease which can be profitably employed to combat cockchafer beetles. If the well-equipped laboratories of France staffed with trained bacteriologists who have been concentrating on this question for the last thirty years or more have not yet solved the problem of effective control of these beetles by the use of contagious diseases, we can, I think, afford to disregard this phase of insect control, and turn our attention to the above-mentioned remedial methods which have given positive results in the field.

As already pointed out in various reports published by our Sugar Bureau, the fumigation of soil infested with cane-grubs offers the greatest possibilities in this connection. Both paradichlorobenzene and carbon bisulphide have been proved effective against these pests during the past season under practical field conditions. The cost of such treatment is certainly high, but in many cases growers are using a mixture of two fumigants when one of them would do the work required, thereby needlessly incurring an additional outlay of 20s. or more per acre. In any case, the advantages of grub fumigation must be apparent to all concerned, when one reflects that on a crop, say, of 30 tons to the acre, four of those tons would cover the cost of such fumigation, and thus save the remaining 26 tons of cane; whereas, otherwise, the entire yield might be lost, together with the ratoons for the following season.

Regarding the question of using guns designed to eject poisonous gas, with the view of destroying beetles when congregating in their feeding-trees, such procedure would perhaps be feasible; but the chances are that many of the beetles when first aroused from their torpidity would seek to escape by flight before becoming overpowered by the toxic gas.

A simpler plan, I think, is to collect them in the usual way by shaking these trees just after daybreak. This method of capture does not alarm but merely causes them to release hold upon the leaves and fall to the ground, where they usually remain in a sleepy condition until picked up and thrown into a sack. Such work, which can be done by boys or children, should be carried out in all districts where serious trouble is being caused by this cockchafer beetle.

CONGRESS OF TECHNOLOGISTS.

The Vice-Chairman of the Australian Section of the International Society of Sugar Cane Technologists (Mr. H. T. Easterby) has been advised that the Fourth Congress of the society will be held at San Juan, Porto Rico, early in 1932—probably in the month of March. It is particularly desired that a strong delegation of Queensland sugar technologists should attend, as it is hoped that the following Triennial Convention will be held in Queensland in 1935. The Queensland Society of Sugar Cane Technologists intend sending a delegate, and it is hoped that others will also be sent. These congresses are becoming of increasing importance, and Queensland's most important agricultural industry must be kept to the fore.

At Porto Rico, next March, the sugar season will be in full swing, the climatic conditions most favourable, and visitors will be able to see more of the sugar industry in both field and factory than at any other season of the year. There will be many excursions to sugar plantations and other places of interest. The Conference held in Java in 1929 was eminently successful, and a great amount of most useful work was accomplished. It gives the delegates an opportunity of meeting the most brilliant sugar-cane scientists from all parts of the world.

LIME FOR CANE LANDS.

With the very encouraging results which have been obtained in North Queensland during the past year or two, following the application of lime on acid soils, we are constantly receiving inquiries from interested growers for advice as to whether their land would benefit from the use of this material.

For the guidance of growers interested in this subject, we would offer the following advice:—Before purchasing lime for your land take a soil sample of your block and forward it to us for a test of its lime requirement. The sample taken should be representative of the soil on the block, and therefore a portion of the surface soil to plough depth should be taken at several points in the field, and the whole thoroughly mixed. A sample of this mixed soil of about 1 lb. weight should be placed in a suitable container labelled with the name of the grower. A note from the latter despatched at the same time as the sample should state that advice on the lime requirement of the soil is desired.

Growers in the Northern areas should forward their samples to the Chemist in Charge, Sugar Experiment Station, South Johnstone. Farmers in those districts south from Townsville should address samples and correspondence to the Director, Bureau of Sugar Experiment Stations, Department of Agriculture, Brisbane.

ANTS IN CANEFIELDS AND BUILDINGS.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following report for the period of March to May, 1931, from the Entomologist at Meringa, Mr. E. Jarvis:—

THE name *ant* is sometimes applied erroneously to termites, which, although commonly called "White Ants," are not, however, related in any way to the Formicidæ, or true ants, these being mostly of small size, and when in the female or worker forms able to sting more or less severely.

Amongst the several hundred Queensland species only very few are known to cause annoyance to man, either by entering buildings or infesting the roots of cultivated plants. As a matter of fact, we cannot be said to possess even a single really aggressive species, such, for instance, as the dreaded "Fire Ant" (*Myrmica*

saevissima), whose sting has been likened to a stab from a red-hot needle, and which is known to completely undermine a whole village, finally compelling the inhabitants to desert it; or the celebrated "Driver Ant" (*Dorylus* sp.), which periodically turns people out of their houses at a moment's notice, while its passing hordes ransack every building, destroying all animals or insects which happen to be surprised or fail to decamp quickly enough.

Probably the most troublesome ant in Queensland at the present time is *Pheidole megacephala*, an introduced species which has become naturalised, and is known to occur also in Mauritius and elsewhere. Its presence in the Cairns district dates back to the year 1901, when it appears to have been already well established in cane-fields. This pest has exterminated many species of our native ants and other insects; and at Meringa I have found it invading the nests of little birds and killing the defenceless young ones just hatched from the eggs. Such facts serve to illustrate the possibilities that may result from the introduction of any insect which is able to exterminate in this manner numerous native species of the animal kingdom, the destruction of which cannot ultimately fail to exert an influence on the fauna and flora of the province invaded, thus upsetting to some extent the existing balance of nature.

Control Measures.

Certain ants have attracted more or less notice from growers, on account of their having been found nesting in considerable numbers amongst the roots of cane-stools. As a reply to various recent inquiries in this connection, the following additional information will doubtless be of general interest. The commonest species of those likely to infest cane-plants is an ant about 3/16ths of an inch in length, the entire body of which—including its long legs and antennæ—is of a uniform light yellow colour. Good results have been secured by saturating the nest of such insects with an emulsion prepared as follows:—

Dissolve three-quarters of a pound of soap in half a gallon of boiling water, and then add 1 gallon of kerosene, a little at a time, while violently churning the mixture until a creamy liquid is obtained; add to this three-quarters of a gallon of creoline, and churn well until mixed. When using this emulsion, dilute it to 2 per cent. with water, and apply at once to the nest. Another method is to remove the top soil around an affected stool to a radius of about 1 foot and a depth of 2 to 3 inches, and then substitute in its place some moist, sifted sand or earth, with which arsenate of lead has been thoroughly mixed at the rate of about 5 lb. to each bushel. For nests situated in headlands or near cane-stools, a 2 per cent. solution of lysol, or a 10 per cent. solution of cresyl, has proved satisfactory.

Non-poisonous Methods.

Lay pieces of sponge containing sweetened water in the runs of ants entering houses, and when swarming with them dip same into scalding water. Plates or pieces of flat tin, when smeared over with lard grease, attract these insects in great numbers; boiling water should be poured over these at intervals.

Substances which have been recommended as deterrents are powdered naphthalene, borax, cedar oil, tobacco dust, sulphur, pyrethrum, &c.; these should be scattered on floors or shelves at the points of entrance, or along the run-ways. Treatment of nests of *Pheidole* ants with hot water has been reported as successful in Africa; such work being carried out after the wet season when most of the ants are near the surface. In dealing with very large nests, these are exposed by removing the top soil and passing a painter's blow-lamp over the disturbed surface.

For many years past the present writer has protected hanging shelves—used for holding breeding cages containing caterpillars and other living specimens—from invasion by ants by merely tying a small piece of cotton-wool tightly around the wire just above the shelf, and covering this and an inch or two of the wire above it with ordinary axle grease. Complete and permanent protection is afforded by this simple method, which, when applied to indoor shelves, will last for a year or more without needing to be renewed. To make tables ant-proof, the legs should be stood in shallow tins about 5 inches in diameter and 3 inches deep, which are then filled to a depth of about one-third with melted paradichlorobenzene. The volatile fumes arising from this chemical, being heavier than the air, will fill the tins and overflow same, creating a repellent atmosphere. The odour, however, is not pronounced enough to be objectionable to those in the house, and is not injurious to human beings. Liquid paradichlorobenzene crystallises into a hard mass in about half an hour, and evaporation can be greatly retarded by covering the surface with a layer of water, which soon becomes odorous enough to act as a repellent to ants attempting to cross the surface.

Fumigating Infested Soil.

Calcium cyanide has been advocated for fumigating the nests of ants in place of carbon bisulphide. Large nests situated on headlands, however, are best fumigated with carbon bisulphide, or by the arsenic-sulphur treatment. Calcium cyanide powder, blown into the nests by means of a foot-pump, has also proved an effective control measure. Ants are frequently destroyed in immense numbers by attracting them to trap-boxes containing decaying vegetation, which, later on, when infested with large nests or communities, can be fumigated with carbon bisulphide or treated with boiling water.

Some Effective Poison-Baits.

A simple poisoned syrup can be made from ½ lb. of sugar, 1 pint of water, 62 grains of sodium arsenite, and 1 dessertspoonful of honey. A few drops of this bait are placed on pieces of glass and laid in the run-ways.

Another good bait consists of the following ingredients:—Water, 1¾ pints; tartaric acid crystals, 30 grains; sodium benzoate, 45 grains; sugar, 2.2 lb.; honey, 3½ oz.; and sodium arsenite, 108 grains. This poison has proved very effective in Italy against the Argentine ant.

A formula which has given excellent results in France should be mentioned here. Take a solution of 473 parts (by weight) of white sugar, add 2 of sodium arsenite, 0.61 of tartaric acid, and a little sodium benzoate, and colouring matter. Boil this together in water, keeping up the amount of water as it evaporates to maintain a total of 1,000 parts by weight.

Poisoned Barriers.

Articles of furniture, such as dressers, tables, &c., can be protected from ants by fastening around the legs or other supports a piece of lamp-wick or tape about 1 inch wide which has been dipped into a strong solution of corrosive sublimate dissolved in methylated spirits and then dried. Ants will not attempt to cross this barrier, because of the risk of getting the minute crystals of this deadly poison on their feet. This method should not be used in houses where there are young children. A good way of making dining-tables ant-proof is to surround the top of each leg—in such position as will be out of sight—with a narrow band of tin, and smear the surface of same with ordinary axle grease.

PLATE 95.—NORTH COAST PINEAPPLES.

A fine consignment of Pines ready for the Southern market. Average weight, 7 lb. Grown by C. H. Ham, North Arm, N.C.L.

FLAG SMUT IN WHEAT EXPERIMENTS, 1930.

By R. B. MORWOOD, M.Sc., Assistant Plant Pathologist.

EXPERIMENTS on flag smut in wheat initiated in 1929 were continued during the 1930 season, at the Roma State Farm. The writer is indebted to the manager and staff of the farm for the provision of prepared lands, for assistance in all stages of the work, and for careful compilation of the records of field germination.

Of the four experiments, the first was a comparative failure on account of weather conditions as explained below. The remaining experiments confirmed and extended the results obtained in the previous season, points of greatest interest being:—

Bluestone treatment effectively controls seed-borne infection of flag smut without detrimental effect on the germination of the seed treated.

Copper carbonate dressing is not satisfactory for the control of this type of infection unless the quantity of smut spores on the seed is so small that they cannot be detected by the unaided eye. Results obtained by other investigators allow one to add that a similar rule could be applied in connection with the control of wheat bunt.

Varietal Susceptibility.

Experiment No. 1 consisted of trials of the susceptibility of the varieties shown to be more resistant in 1929 and of several others previously untested. Seed of these varieties was heavily infested with spores of the flag smut fungus, *Urocystis tritici*, and planted in four blocks. There was one row two chains long of each variety in each block. The order was randomised. The experiment was planted on the 7th and 8th of May in somewhat dry soil. The wheat was watered as planted to ensure germination. Rain fell immediately afterwards, and the wheat grew to maturity in spite of low soil moisture during the later stages and a severe rust epidemic. The percentages of plants developing symptoms of flag smut are given in Table I. It will be seen that the infection was low, Canberra averaging only 2·8 per cent. Consequently the results are of little value and no conclusions can be reached from the other low percentages except that the highest of them—Warren 1·9 and Sultan 2—indicate susceptibility in those two varieties. It is to be noted that there was no infection in the Sultan selection under the conditions of the experiment.

The low infection in spite of heavy seed contamination is explained by the relatively high temperatures during germination of the wheat. The average daily maximum temperature for the six days following planting of Experiment I. was 73 deg. Fahr. and the average minimum 55 deg. Fahr. These figures are considerably higher than those for Experiment II., where the average maximum was 69 deg. Fahr. and average minimum 39 deg. Fahr. for a similar period. In the latter experiment an average infection of 24 per cent. was obtained in the checks.

At low temperatures wheat germinates very slowly, the rapidity rising with rise of temperature till it reaches a maximum at 82 deg. Fahr.

Flag smut spores will germinate moderately well at low temperatures and reach a maximum at 64 deg. Fahr. Above this temperature their vigour of germination diminishes.

More rapid germination of the wheat or retarded germination of the flag smut spores gives the seedling a better chance of passing safely through the stage in which it is susceptible to infection. Within reasonable limits, therefore, rise in temperature gives lower infection of flag smut. This is of great interest in connection with the low incidence of the disease in Queensland as compared with the cooler Southern States.

TABLE I.

PERCENTAGE INFECTION.

Variety.	Block I.	Block II.	Block III.	Block IV.	Average.
Currawa	0	0	0	0	0
Canberra	0	3·1	2·8	1·6	1·9
Florence	0	0	1·3	1·6	0·7
B.F.G. 2628	0	0	0	0	0
C.C.C. 2702	0	0	0	0	0
Sultan	1·4	5·1	0	1·5	2
P.I.P.M. 2612	0	0	0	0	0
Canberra	2·8	4·6	1·5	3·4	4·1
Waterman	0	0	1·6	0	0·4
Waratah	0	1·3	1·7	0	0·7
B.I.P.M. 2617	0	0	0	0	0
B.I.P.M. 2615	0	0	0	0	0
Warren	0	2·5	5·1	0	1·9
Bunge No. 1	0	0	0	0	0
Canberra	1·6	1·4	4·4	0	1·8
B.I.P. 1301	0	1·6	0	0	0·4
B.I.P.M. 2604	0	0	0	0	0
Warchief	0	0	0	0	0
B.F.G. 2627	0	0	1·4	0	0·3
B.I.P.M. 2610	0	0	0	0	0
B.I.P. 1346	1·6	0	0	2·9	1·1
Canberra	1·4	9·2	4·6	3·2	4·6
B.F.G. 2703	0	0	0	1·6	0·4
Roma Red	1·4	0	1·4	0	0·7
Sultan Selection	0	0	0	0	0
Nabawa	0	0	0	0	0
B. Man. 33	1·1	0	0	0	0·3
B.I.P.M. 2602	0	0	0	0	0
Canberra	4·1	0	0	3·2	1·8
B.I.P.M. 2704	0	0	0	0	0
					0·19
Canberra, Average ..	..	..	..	..	2·8

Seed Treatment.

Experiments Nos. II., III., and IV. were trials of various seed treatments. Seed infested with Flag Smut was treated and planted and the germination and development of smut noted. For Experiment II the seed was heavily infested by shaking with Flag Smut spore material at the rate of approximately 1 lb. per bushel, for Experiment III. the seed was shaken with spore material at the rate of 2 oz. per bushel, and for Experiment IV. at the rate of ½ oz. per bushel. The spore material on the latter could only be detected with difficulty, though

careful examination with a lens revealed numerous spores on each grain of wheat. In Experiment II. treatments with Bluestone, Bluestone followed by Lime, Hot Water, and Copper Carbonate dust were tried. In Experiments III. and IV. only Bluestone and Copper Carbonate treatments were used. The details of treatment are as follows:—

Bluestone.—The seed was immersed for three minutes in a 1½ per cent. solution of Bluestone, then drained and dried.

Bluestone—Lime.—The seed was immersed in Bluestone as above and then immersed for three minutes in a 1 per cent. suspension of slaked lime in water before being allowed to dry.

Hot Water.—The seed was soaked in water for four hours and was then immersed for ten minutes in a water bath maintained at a temperature of 129 deg. Fahr. with constant stirring. It was then quenched in cold water, drained, and dried.

Copper Carbonate.—The seed was shaken with Copper Carbonate dust at the rate of 2 oz. per bushel.

All treatments were carried out ten days before planting. The seed was planted in four blocks of randomised rows.

These experimental plots were first planted on 12th May, using Canberra wheat, but, owing to the destruction of a large number of the plants by birds, the planting was duplicated later, using Watchman seed. The accompanying germination results are of this second planting. The hot water treatment was the only one to significantly reduce germination, though both Bluestone and Bluestone and Lime delayed it slightly. Tables II., III., and IV. show the germination in Experiments II., III., and IV. respectively. Table V. shows the infection in these experiments.

TABLE II.

PERCENTAGE GERMINATION.

Treatment.	Block I.	Block II.	Block III.	Block IV.	Mean.
Bluestone	78	85	90	93	86·5
Bluestone and Lime ..	84	93	87	90	88·5
Untreated	71	84	82	89	81·5
Free Untreated	69	78	89	87	80·75
Hot Water	43	56	52	58	52·25
Copper Carbonate ..	79	84	84	83	82·5
Untreated	74	79	86	88	81·75
Block Means	71·14	78·86	81·43	84	79·11

Variation.	Degrees of Freedom.	Sum of Squares.	Variance.
Within Treatments	21	777·81	..
Between Blocks	3	649·71	..
Random	18	128·10	7·116

Standard error of comparison of two treatment means $= \sqrt{\frac{7{\cdot}116 \times 2}{4}} = 1{\cdot}886.$

A difference of 5 percentage germination would indicate odds 20 : 1 for significance.

TABLE III.

PERCENTAGE GERMINATION.

Treatment.	Block I.	Block II.	Block III.	Block IV.	Mean.
Bluestone	87	85	85	87	86
Copper Carbonate ..	86	83	86	91	86·5
Untreated	77	85	83	89	83·5
Block Means	83·33	84·33	84·67	89	85·33

Variation.	Degrees of Freedom.	Sum of Squares.	Variance.
Within Treatments	9	118	..
Between Blocks	3	56·64	..
Random	6	61·36	10·226

Standard error of comparison of two treatment means $= \sqrt{\frac{10{,}226 \times 2}{4}} = 2{\cdot}26$. A difference of 5·5 in percentage germination would indicate odds 20 : 1 for significance.

TABLE IV.

PERCENTAGE GERMINATION.

Treatment.	Block I.	Block II.	Block III.	Block IV.	Mean.
Bluestone	87	91	87	83	87
Copper Carbonate ..	92	87	82	87	87
Untreated	90	84	83	83	85
Block Means	89·6	87·3	84	84·3	86·3

Variation.	Degrees of Freedom.	Sum of Squares.	Variance.
Within Treatments	9	116	..
Between Blocks	3	64·65	..
Random	6	51·34	8·557

Standard error of comparison of two treatment means $= \sqrt{\frac{8{,}557 \times 2}{4}} = 2{\cdot}066$. A difference of 5 in percentage germination would indicate odds 20 : 1 for significance.

TABLE V.

PERCENTAGE INFECTION.

Treatment.	First Sowing, Canberra.*					Duplicate Sowing, Watchman.				
	Block I.	Block II.	Block III.	Block IV.	Average.	Block I.	Block II.	Block III.	Block IV.	Average.
Experiment II.—										
Bluestone	0	0	0	0	0	0	0	0	0	0
Bluestone and Lime ..	0	0	0	0	0	1·3	1·1	0	1·1	0·9
Untreated	21·4	32·5	40	21	28·7	26·7	19·7	26·7	15·8	22·2
Free Untreated	0	0	0	0	0	0	0	0	0	0
Hot Water.. ..	0	0	0	0	0	0	1·8	0	0	0·4
Copper Carbonate.. ..	0	3	0	0	0·8	7·6	3·6	4·8	6	5·5
Untreated	15·7	18·1	24·4	18·5	19·2	16·2	31·8	12·1	10	15
Experiment III.—										
Bluestone	0	0	0	0	0	0	0	0	0	0
Copper Carbonate.. ..	0	0	0	0	0	0	1·1	1·1	1·1	1
Untreated	4	10·3	0	0	3·8	2·6	5·9	8·4	3·4	5·1
Experiment IV.—										
Bluestone	0	0	0	0	0	0	0	0	0	0
Copper Carbonate.. ..	0	0	0	0	0	0	0	0	0	0
Untreated	4·5	3·2	0	0	1·9	1·1	0	2·4	3·8	1·8

* Bulk of plants destroyed by birds.

Consideration of the infection taking place leads to the following conclusions:—

Bluestone effectively controls seed-borne infection of Flag Smut.

Treatment of seed with *Lime after Bluestone* is liable to impair the effectiveness of the Bluestone.

Hot water did not show its usual complete control, as one plant in one of the hot water rows was infected. It seriously reduced germination, and is impracticable as a method of control.

The most interesting results are found in the treatments with *Copper Carbonate*. The standard dressing with this dust completely controlled infection in the lightly infested rows, but permitted some small infection in the rows planted with seed with medium infestation and quite considerable infection from heavily infested seed. This correlates well with the previous season's results when only heavily infested seed was used and the conclusion was reached that copper carbonate dust is not satisfactory for treating Flag Smut-infested wheat.

Readers are reminded that a cross in the prescribed square on the first page of this "Journal" is an indication that their Subscription —one shilling—for the current year is now due. The "Journal" is free to farmers and the shilling is merely to cover the cost of postage for twelve months. If your copy is marked with a cross please renew your registration now. Fill in the order form on another page of this issue and mail it immediately, with postage stamps or postal note for one shilling, to the Under Secretary, Department of Agriculture and Stock, Brisbane.

OUTLINE OF APIARY INSPECTION IN THE BRISBANE AND ADJACENT DISTRICTS.

By HENRY HACKER, Entomological Branch.

IT might be mentioned, by way of introduction, that an apiary badly affected with American foulbrood was reported early this year from the Pine River district. As soon as the disease was definitely diagnosed the entire apiary, consisting of twenty-five colonies, was destroyed by burning.

As a result of this infestation it was thought advisable to make a survey of the apiaries situated within about fourteen miles of Brisbane. In the north a little wider area was included, embracing the Petrie and Samford districts. All the apiaries that could be found within this area have now been carefully examined and no trace of infectious disease has been found.

Altogether 116 apiaries, totalling 2,024 colonies, have been visited. These are owned by 107 beekeepers. There are probably others who have been overlooked owing to their addresses being unknown.

Eight people keep but a single hive merely to provide honey for the household or as a subject of nature study. On the other hand, several beekeepers own over 100 colonies which are distributed in several different localities. Some farmers also keep a few colonies and add to their incomes to some extent in this way.

Grading of Apiaries.

During the inspection work the general condition of the bees, equipment, &c., at each apiary was noted, and roughly classified into four grades; it is also a classification of the beekeeper as reflected by the condition of his apiary.

Excellent.—Standard frame hives well painted; colonies of even strength, with Italian queens. Apiary well equipped, bearing evidence of good management and the bees of good attention.

Although only a few of the apiaries came up to this high standard, a number classed as good would have fulfilled the conditions if the few weaker colonies were built up to uniform strength.

Good.—Standard frame hives. Colonies often of uneven strength and demanding more attention; the queens sometimes of uneven quality.

The beekeepers in this grade generally have a liking for bees and are keen to adopt any methods likely to increase their yield of honey. Pressure of other work is generally the cause of any neglect that the bees exhibit. The largest proportion of the apiaries examined belong to this grade.

Fair.—Frame hives roughly made with odd-sized timber, or fruit cases adapted, generally containing hybrid bees. With a little advice and assistance, many in this grade would soon qualify as good.

Bad.—Box hives, or frames in old and badly fitting boxes, the frames being unwired, badly spaced, and stuck together. Hybrid bees generally obtained from trees in the bush.

With bees kept under these conditions it is impossible to remove the frames without breaking them. The owners show very little interest in their bees and seem satisfied with small quantities of inferior honey. The proportion of apiaries included in this grade was small.

Diminishing Yields in the Brisbane District.

Many beekeepers state that their locality is yielding smaller quantities of honey year by year. This is chiefly owing to the destruction of trees due to the inevitable growth of the city, especially in the outer suburbs. Flower gardens, though of no use to the bee farmer on a large scale, help the town dweller with his one or two hives, but it takes a large area of plants to provide a really adequate supply.

Another reason for the diminished yield is the fact that since the original beekeepers settled in their localities others have encroached on their foraging grounds, with the result that the average returns per colony are now lower.

The weak condition of many colonies early in the year was very noticeable. The long dry spell at Christmas, causing a honey and pollen famine, was probably the chief cause, although in some instances the weakened state was probably brought about by over extracting. Many colonies were reduced to a handful of bees clustered on a few inches of brood. Immediate feeding was recommended where there were no colonies strong enough to have honey or brood comb to spare for the weaker ones.

Brisbane District Overstocked.

The total number of colonies within this area is greater than was expected and even the more favourable localities appear to have too many beekeepers congregated upon them, with the result that the apiaries cannot expand sufficiently to become their sole occupation. Speaking generally, the area under review may be considered more than fully stocked, and the prospective beekeeper would be well advised not to attempt commercial beekeeping within fifteen to twenty miles of the city, but rather to go further afield where vast areas of bee pasturage are at present unoccupied, providing more scope for future expansion and much better prospects of success.

Caboolture, Nambour, and Yandina Districts.

The inspections carried out in these districts were not so intensive as the Brisbane survey, only a certain proportion of the apiaries being examined. No case of foulbrood had been recorded from the Caboolture, Nambour, and Yandina districts, hence an intensive survey was not called for. All the colonies were found to be healthy and were generally in a stronger condition than those in the metropolitan areas. This was due to a good flow from the tea-tree, accompanied by mild weather during the period of inspection.

No Further Cases of Foulbrood.

It is gratifying to state that no further outbreaks of foulbrood have been discovered and it is hoped that the disease has been eliminated from Queensland, at any rate for the present.

DISEASES OF THE PIG.*

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

[*Continued from the April issue.*]

PART V.

In the preparation of information dealing with Diseases of the Pig, an endeavour has been made to describe in the simplest language possible the various conditions, abnormal and otherwise, associated with the incidence or appearance of disease in swine. The suggested preventive measures and methods of treatment are such as may be successfully carried out by any careful farmer, excepting only in cases where the services of a qualified veterinarian are advised, and in these cases the best methods to follow will be suggested on the spot by the surgeon himself.

The pig is notoriously a bad patient and a difficult animal to handle when indisposed, hence great stress has been laid throughout this treatise on the necessity of preventive measures, for prevention is not only much better than cure, but is invariably less costly and a great deal more satisfactory.

In dealing with methods of treatment and the engagement of qualified aid, it has been realised there are numerous difficulties in the way, because Departmental officers or practising veterinarians are not always immediately available in town or country districts. Again, therefore, we stress that prevention is better than cure, and we might even qualify this further by adding prevention is more necessary than cure.

Mr. Shelton's bulletin, representing as it does much labour and the fruits of careful study and observation, is a welcome contribution to current pig literature.—EDITOR.

SUNBURN OR SUNSCALD.

THIS is, strictly speaking, not a disease. It is simply due to the effects of the sun on the tender, somewhat unpigmented skin of the pig. White pigs, being unprotected with pigment, invariably suffer more than black or red pigs, and a badly sunburnt pig, particularly if his ears have been frost bitten, is a difficult patient to treat. Pigs need protection from the effects of the weather. For hot climates white pigs that have a comparatively thick coat of hair should be selected, the soft-skinned, light-coated types are quite unsuitable. The symptoms of sunscald are that the skin cracks and burns, and the scabs or scars attract and become covered with dirt. Treatment must be both preventive and curative and must first aim at removing the cause. The pigs must be housed in a clean, comfortable, well-protected sty or a shady yard. They should be carefully washed with warm soapy water and after drying should be oiled with carbolised vaseline, petroleum

* The typescript and illustrations of the Farmers' Bulletin on Diseases of the Pig have been submitted to the Chief Inspector of Stock, Major A. H. Cory, M.R.C.V.S., Department of Agriculture and Stock, Brisbane, Queensland.

Copies of the Bulletin when completed may be had gratis on application to the Under Secretary, Department of Agriculture and Stock, Brisbane, Queensland.

In the compilation of this paper the writings of recognised authorities in other States and other parts of the world have been drawn on, and the assistance thus received, also that freely given by other Departmental officers, is acknowledged gratefully.

jelly, or coconut oil, to soften, cleanse, and heal the skin. The use of a mixture of kerosene and fat, though crude and sometimes effective, is not by any means a reliable skin emollient. It will, of course, be necessary in treating stock to keep the pigs under sanitary conditions and to give them ample nourishing foods.

Only such stock as are suited to the climatic conditions should be kept. It would not be correct to say that white pigs are unsuitable for hot, dry districts, or the more humid districts of the North, for white pigs can live and do well in any district, provided they have the necessary care and attention. They certainly cannot stand the rougher or more exposed conditions that black and red pigs endure.

It does happen occasionally that pigs grazing on a crop of rape, particularly when it is wet after heavy dew or rain, will develop a rash, more or less acute, on their ears and shoulders, their snouts may also become inflamed. This is usually more noticeable in white or red pigs than in black pigs. It is, however, of a temporary nature only, except where accompanied by lice irritation and frost-bitten ears.

It is not good practice to allow pigs to graze too long in paddocks that become soft and slushy with rain. They should be turned on to drier ground and the food be carted to them until the weather clears up.

PLATE 96.

Fig. 1.—Inflammation of the sheath in a young boar pig. This is a fairly common trouble in male pigs under twelve months of age. Careful massage of the parts to remove accumulations of urine followed by thorough cleansing of the surrounding areas is advised. During treatment the affected animal should be kept away from other stock in a clean, dry sty, and be fed liberally on nourishing foods of a laxative nature.

Abscess Formation.

Pigs of all ages occasionally suffer from one or other form of abscess, which may be the result of internal ailments or be due to local causes. Such abscesses usually burst and discharge their contents in the form of pus. But in other than very young animals the skin is often so tough that the abscess will not point, and the pus gravitates to the lower levels of the affected part.

Apart from internal abscesses due to tuberculosis, parasites, &c., most of the external abscesses to which the pig is subject are due either to splinters of wood, grass seed, or to old sores that have improperly healed. The largest abscesses usually result from improper castration.

Symptoms.—The abscesses are usually either in the form of a lump slowly developing or the fully developed boil, ready to burst or already having burst. They may appear on any part of the body. A common form of abscess is that in which a bite from another pig becomes inflamed and septic (the ear being a common seat of this trouble), enlarges considerably, and becomes infiltrated with pus. The pain due to pressure causes the pig to carry its head on one side. A similar condition may also be brought about by infection from the throat gaining access to the middle ear, through the eustachian tube. Abscesses causing great pain and loss of condition may result in death.

Abscesses are also frequently formed between the digits and in such cases the foot will be much enlarged. In young boars, the sheath is a common site of trouble. (See fig. 1.) Abscesses which involve the

PLATE 97.

Fig. 2.—Abscessed areas resulting from infection following improper castration. This pig had been castrated several weeks before this photograph was taken; the abscess had been developing, and meantime the animal suffered great pain though, strangely enough, he continued to thrive, though growth is always slower in cases like this than with normal pigs.

scrotum or purse are the result of improper castration, the pus from which may infiltrate the tissues immediately surrounding the operation wound. (See fig. 2.)

Treatment.—The first step to be taken must be to ascertain the cause which will be largely determined by the situation of the abscess. The affected area should be thoroughly washed with warm water to which disinfectant has been added, and then the fingers should be carefully passed over the area in an effort to discover a soft spot.

When this has been found, and if it appears to yield under slight pressure, it should be lanced with a clean sharp knife that has previously been placed in methylated spirit. Care must be taken to lance the

abscess in such a position that the discharge will drain away freely from the opening. The cavity should then be cleaned out by means of a small household syringe and disinfectant solution and the wound wiped dry, after which boracic powder or Calvert's disinfectant powder may be dusted on. In order to assist the abscess in pointing, the enlargement may be painted with liniment of iodine.

If the abscess has not developed a soft spot it should be watched carefully for a few days. In the case of abscesses resulting from improper castration, the opening must be made well down under the affected area so that all the pus may readily drain clear. The cavity should be washed out daily and massaged well in order to ensure the expulsion of pus, and plenty of dry boracic powder or Calvert's disinfectant powder be applied to keep the wound free from flies.

PLATE 98.

Fig. 3.—Another case of abscess formation, the result of infection. The abscesses in this case had broken out and were suppurating an evil-smelling pus. Abscessed areas like this take months to clean out and heal up. They can be prevented by following proper methods in the operation of castration.

Pyaemia.

Pyaemia, or the formation of multiple abscesses, is a term used to indicate that abscesses have formed in different parts of the body of the affected pig, and that once having originated they are liable to spread from one part of the body to another by metastatic action. Pyaemia is really a form of blood poisoning (septicaemia)), though it is not usually so severe as in those cases in which the animal has become weakened by continued illness.

In animals that are otherwise healthy and in good condition, pyaemia is a very rare disease. It usually finds its best host in the sickly, half-starved, hidebound animal, whose powers of resistance have been lowered by starvation and who is not able to battle against illness.

Pyaemia is essentially a germ disease, and treatment must aim at cleansing the blood and putting the animal in first-class condition. There is no other recognised treatment, but preventive measures, if adopted in time, will do much to restore the animal to normal condition.

The carcase of a pig suffering from pyaemia would be totally condemned by the meat inspector.

Treatment of Wounds.

A clean incised wound made by a sharp instrument needs little other attention, if kept clean, than painting with tincture of iodine. If necessary it may expedite healing if one or two stitches are inserted in the wound to prevent the parts sagging open. Do not wash such a wound too much, as this prevents healing; boracic acid and a little iodoform may be dusted on to keep flies away.

PLATE 99.

Fig. 4.—Nipping off the sharp, black, "needle" teeth of sucking pigs prevents a great deal of trouble resulting from laceration of the lips and tongues of the litter mates during meal times when the suckers fight for their place on the teats. It also prevents injuries to the sow's udders and teats, and is beneficial in every way without injuring the young pigs from whom the sharp teeth are removed. The teeth should be cut back close to the gums when the suckers are a day or two old. Paint the gums with a dilute solution of tincture of iodine before releasing the animal.

Jagged, Torn, or Punctured Wounds.

Jagged, torn, or punctured wounds caused by the animal coming into contact with stakes, nails, barbed wire, &c., cause more trouble, for there is generally a quantity of dirt embedded in the tissues that needs careful syringing and draining out. First trim up the wound by cutting off with a pair of sharp scissors any portions of skin projecting into the wound, also clip the hair around the area. Then carefully wash with a solution of lycol, condy's crystals, or other disinfectant. It is very necessary to be certain that the wound is thoroughly cleansed inside and that healing takes place there before surface healing.

When quite clean dust on boracic acid and iodoform, equal parts, or apply zinc ointment. The use of dry dressings subsequently instead of wet lotions promotes healing. Dry dressings also protect the wound, and should be continued until the wound has healed and cleared up. The floors of the sty and the surroundings generally should be kept scrupulously clean.

Necrotic Ulcers.

This trouble, also referred to in some publications as necrotic rhinitis, necrobacillosis, bullnose, ulceration, &c., indicates a diseased condition of the skin and flesh on one or other portions of the body, and the sloughing or decaying off of portions of the tissue. It is not common in well-kept pigs, though the formation of ulcers that are difficult to heal or treat are noted now and again. The condition described as necrobacillosis results from infection by the germ technically known as "Actinomyces necrophorus." The germs enter by way of wounds or other injuries caused by fighting (particularly in very young pigs) or by mouth, lip, or tongue injuries caused by rough, sharp bones, glass, or other objects in the food. The disease sometimes localises itself in the skin, and in this case, of course, treatment would be different to that where the mouth and lips are injured.

Plate 100.

Fig. 5.—Tooth nippers of this description are advised for use in the operation referred to in fig. 4. They are not expensive and will last a long time if carefully handled, wiped dry, and rubbed over with an oily cloth before putting away.

In some instances it has been noted that a similar condition attacks very young pigs before weaning. Scabs occur on the cheeks and gradually spread up and over the head. The eyelids close, and there is a discharge. The hair loses its lustre, the animal mopes, and dies in about ten days. Sometimes the face is eaten away until the bone shows and becomes fly-blown. In these cases it is evident the pig's face has become infected with bacillus necrosis, this bacillus eating its way into the parts. The probability is that the pigsties would become infected by diseased pigs, hence in handling the trouble it is better to immediately kill off and burn the affected animals. Dressing the wounds with a 2 per cent. solution of lysol (teaspoonful to a pint of sterile water) is advised, as also painting with tincture of iodine. Attention to the general health of the animal, isolation of affected stock, and general sanitary measures are advised. For application to the open wounds a mixture of twenty parts of glycerine and one part of carbolic acid or a dilute solution of iodine is helpful.

Swine Erysipelas.

This disease is not common in Australia, but in some parts of the world is a source of considerable trouble. Mr. G. A. Goodchild, in a recent issue of the Journal of the Large Black Big Society, stated that "far greater confidence would be placed in (English) pig breeding were it not for the elusive disease erysipelas, which causes greater loss in the eastern counties of England than all other diseases combined."

This is not the trouble here, though a few notes will be of interest. The disease is due to a specific bacillus. In Great Britain, as a rule, the disease attacks fat pigs and usually in the summer months, though under favourable weather conditions it may also appear at any season of the year.

The disease is one that should be attended to by a competent veterinarian. It attacks adult pigs more so than young stock. There are no definite or reliable symptoms that would indicate to the layman the occurrence of this disease. Microscopic examination of the blood of an infected animal would be necessary. The disease is sometimes mistaken for swine fever, the discoloration of the skin being the lesion resembling the latter disease. In a skin disease of this description diamond-shaped red discolorations are more diagnostic of swine erysipelas than swine fever or swine plague.

Preventive treatment overseas is almost entirely vaccination. An immunising serum may be used in the prevention of the trouble with considerable success. Swine that recover from an attack of swine erysipelas are often immune from future attacks.

A local disease in pigs, sometimes referred to as diamond spot disease, is probably due to digestive disorders, to infestation by ringworm, lice, or perhaps to the use of sawdust, shavings, or other dusty bedding.

Hide-bound.

This trouble indicates lack of vigour and an unhealthy condition of the blood. It results from indigestion, anæmia, general weakness, and is indicated by a peculiar harsh, dry condition of the skin, which may be covered with greyish scurf. In such cases the urine of the animal is highly coloured, is scanty, and contains crystals of a chemical substance known as oxolate of lime. The trouble is exaggerated by irregular feeding, improper foods, non-assimilation of the food, or by feeding on foods containing too high a percentage of sugar; constipation and a feverish sickly condition often accompany the trouble.

Treatment.—Aim at relieving the digestive troubles by changing the food to a light laxative diet with ample green food. Give occasional doses of Epsom salts (use 3 oz. each dose for a full-grown pig, and add an ounce or two of flowers of sulphur). Wash the pig frequently, and keep the skin well oiled. It is suggested that one part of flowers of sulphur to twenty of coconut oil will be a good mixture, once the cause of the trouble has been removed. Give the animal plenty of exercise and fresh water, with dry comfortable quarters to sleep in and a small ration of coconut or linseed oil cake in his food.

Wrinkles in the Skin.

The appearance of wrinkles or creases along the side, back, or neck of the pig does not necessarily indicate a diseased condition of the skin. Male pigs, as they develop age, develop wrinkles. This is often also the case in old sows, especially if they are in low condition. Development of wrinkles is also possibly largely due to hereditary or constitutional predisposition, and can only be overcome by improved breeding, selection, and better methods of feeding. Wrinkles may develop in cases where an animal is suffering from anæmia and debility, and in these cases must, of course, be looked upon more as a symptom than a disease.

Wrinkling and hardening of the skin and the development of a very heavy "shield" on the neck, shoulder, and side of aged boars is common. It is objectionable, and cannot be entirely prevented, though its development may be checked by constant oiling and softening of the skin, and by keeping the animal free from parasites.

It is important that exhibitors of show pigs should note this point.

[TO BE CONTINUED.]

PASTURE IMPROVEMENT.

THE Minister for Agriculture and Stock (Hon. H. F. Walker) announced recently that a Pasture Improvement Committee had been appointed, consisting of Messrs. E. Graham, Under Secretary, and Director of Marketing (Chairman); H. T. Anderson, representing the Council of Agriculture; F. F. Coleman, representing the Department of Agriculture; W. T. Harris, representing the Australian Dairy Council; and B. Shearer, representing the A.C.F. and Shirleys, Limited, and Nitrogen Limited.

At the committee's first meeting it was decided to carry on the experiments laid down in 1930 at Sherwood and Maleny, also to arrange for a further series of experiments in the South Coast districts near Nerang and Beaudesert, three or more experiments to be carried out on the Caboolture-Kilcoy line, and others near Eumundi and Green's Creek, near Gympie. Arrangements are also being made for an experiment in the Murgon district.

The idea in each instance is to make the most of young and short grass which is now accepted as of much better feeding value than grass that has begun to produce flowering stems, as young grass provides a ration that favours milk production and growth generally, against old grass which, in some cases, barely provides for maintenance. Rotational grazing is therefore recommended and the application of a sufficient quantity of suitable fertilizers.

In many of our coastal districts dairymen have found it impossible to establish suitable clovers. In some cases clover seed was sown on a dense mat of long, coarse grass. In other cases the application of small quantities of superphosphate was relied on to produce clovers that had never been sown.

Rotational Grazing.

It is realised that grass is the cheapest food for stock and that it is worth while, by the use of efficient harrows or other implements and the application of fertilizers, to endeavour to extend the grazing period by bringing in grass earlier in the spring and later during the early cold weather. Fertilizers have done this where the land has been thoroughly cleared up before their application—that is to say, the land had been thoroughly harrowed and brought, as far as possible, into the condition that would occur if it had been closely grazed and all droppings spread. To get the fullest effect it is essential that the paddocks be arranged in such a manner as to permit of rotational grazing. This insures the milkers being fed on young growing grass during the extended grazing period.

In order to keep some check on actual production as far as possible, calculations will be made on the following basis:—The number of cows grazed, multiplied by the number of days, and divided by the number of acres.

At Mr. W. S. Conochie's farm, Brooklands, Sherwood, the fertilizers were applied during the last week in August, paddock No. 1 receiving 1½ cwt. sulphate of ammonia and 2 cwt. superphosphate per acre, and in the period from 13th September to 19th November this paddock gave 152.2 cow-days per acre and 39.1 dry-stock days per acre, or a total grazing per acre of 191.3.

In the second paddock, an application of 1 cwt. sulphate of ammonia and 2 cwt. of superphosphate was made, giving 125 cow-days per acre, 45 dry-stock days, and total number of grazing days, 170.

In the third paddock, with an application of 2 cwt. of superphosphates per acre only, the result was 121.2 cow-days, 40 dry-stock days, and a total of 161.2 grazing days.

Paddock No. 4, with an application of 1 cwt. sulphate of ammonia, 2 cwt. of superphosphate, and ¾ cwt. muriate of potash, gave 158.3 cow-days, 52.5 dry-stock days, and a total of 210.8 grazing days.

Paddock No. 5, without fertilizer, gave 64 cow-days, 42 dry-stock days, and a total of 106 grazing days.

PLATE 101.

PADDOCK No. 1.—Showing Growth after First Grazing.
1½ cwt. Sulphate of Ammonia and 2 cwt. Super. per acre.
Fertiliser applied 27th August, 1930.
Photo. taken 22nd October, 1930.

A.—Without Fertilizer.

PLATE 102.

PADDOCK No. 3.—Showing Growth after First Grazing.
2 cwt. Super, per acre.
Fertilizer applied 28th August, 1930.
Photo. taken 22nd October, 1930.

PADDOCK No. 2.—Showing Growth after First Grazing.
1 cwt. Sulphate of Ammonia and 2 cwt. Super, per acre.
Fertilizer applied 27th August, 1930.
Photo. taken 22nd August, 1930.

The question of animal preference must not be overlooked. It was found on the gates being left open that the animals gave a decided preference to the nitrogen-treated paddocks. In the case of the paddock treated with superphosphate only and one without any fertilizers, the animals invariably chose the one top-dressed with superphosphate. This occurred when the gates of the nitrogen-treated paddocks were kept shut. No. 1 paddock, after being shut up for sixteen days, gave 60.9 cow-days per acre on first grazing. On the same basis, No. 2 paddock was shut up for twenty-three days and then gave 75 cow-days per acre at the first grazing. No. 4 paddock was shut up for thirty-one days, and then gave 83.3 cow-days per acre on first grazing, and paddock No. 3, after being closed for forty-one days, gave 90 cow-days per acre on first grazing, and the paddock to which fertilizer was not applied, after being closed for fifty-one days, only gave 64 cow-days per acre.

As regards earliness of bite, paddocks 2 and 4 can be considered as equal. No. 1, however, owing to the additional quantity of ammonium sulphate, gave the first grazing, and No. 4 gave the highest number of total grazing days—practically double that of the area without fertilizers and a great increase over the superphosphate-only paddock. The increases in both Nos. 1 and 2 over the superphosphate-only paddock are also significant.

Feeding Value.

Fair average samples, representing the different paddocks, were cut during September and October. These were analysed by the Agricultural Chemist, Mr. J. C. Brünnich, with the following results (dry-basis analysis):—

SHERWOOD.

			Crude Protein.	Crude Fibre.
15th Sept. ..	Paddock No. 1 ..	Clover only	29·9	16·9
15th Sept. ..	Paddock No. 1 ..	Grass only	18·5	21·1
16th Oct. ..	Paddock No. 1 ..	Composite sample	20·1	26·3
16th Oct. ..	Paddock No. 2 ..	Composite sample	24·6	23·2
15th Sept. ..	Paddock No. 3 ..	Composite sample	25·2	21.3
15th Sept. ..	Paddock No. 4 ..	Clover only	27·4	20·6
15th Sept. ..	Paddock No. 4 ..	Grass only	22·9	23·3
16th Oct. ..	Paddock No. 4 ..	Composite sample	22·7	23·5
16th Oct. ..	Paddock No. 5 ..	Composite sample	19·2	26·9
15th Sept. ..	..	Grass in seed head, not eaten by stock	7·0	32·6

This table should be read in conjunction with previous paragraphs setting out dates of grazing and number of cow-days per acre.

MALENY.

		Crude Protein.	Crude Fibre.
13th Dec., 1930 ..	Paspalum and other grasses in seed head, neglected by stock.	9·2	34·8
13th Dec., 1930 ..	Grass only from paddock top-dressed with 1 cwt. sulphate of ammonia and 2 cwt. superphosphate per acre during last week of October. This paddock should have been grazed about 10 days sooner.	17·2	25·2

It is significant that Mr. Webster, of Maleny, writing after the first good rain, states that he put fifty-seven head into the ammonium sulphate-superphosphate paddock, and it carried them for seven days (area, 2½ acres); further, he was considering the purchase of a horse mower as the grass was coming on so fast he could not keep it down.

Winter Feed.

The committee quite realises that, although it is possible to extend the growth of Paspalum before the cold weather sets in and to bring in the same grass earlier in the springtime, there still remains a gap to be filled. Endeavours, therefore, are being directed to the introduction of suitable strains of grasses and clovers that

PLATE 103.

PADDOCK NO. 5.—Showing Growth.
Without Fertilizer.
Photo. taken 22nd October, 1930.

PADDOCK NO. 4.—Showing Growth after First Grazing.
1 cwt. Sulphate of Ammonia, 2 cwt. Super, and
¾ cwt. Muriate of Potash, per acre.
Fertilizer applied 28th August, 1930.
Photo. taken 22nd October, 1930.

can be relied on to give winter feed, in particular such grasses as Perennial Rye Grass, Cocksfoot, and what is now called *Phalaris tuberosa* (Perennial Canary Grass). The importance of strain in these grasses is not being overlooked, as it is considered that the repeated failure to establish such growth in Queensland is not altogether due to the climatic conditions but may be principally put down to the commercial strains of such plants being in the past saved from ready seeders, the seed grower's intention being to product the greatest quantity of seed, and our present desire—the production of leafiness, density of growth, and, the greatest of all, persistency. Even in the case of Prairie grass it might be possible to produce strains with much greater leaf production. This remark also applies to strains of White Clover which, in some instances, only appears suitable for the production of seed, the quantity of actual leaf being very small.

Trial Plots at Lawnton.

From small trials carried out by the Acclimatisation Society during 1930 it was evident that considerable difference exists in these plants. As a start on this work the Department has now arranged for a large number of plots to be grown for a period of not less than three years at Lawnton. Such plots have been set out in a manner that allows for their extension, if necessary, and for the keeping of careful records as to the persistency of the different strains of both grasses and clovers that will put up with Queensland conditions if kept free from weeds and aided by a light dressing of fertilizers to encourage growth. With work of such character, although progress reports will be made, definite conclusions cannot be arrived at until at least three years.

A PROLIFIC HEN.

By P. RUMBALL, Poultry Expert.

QUEENSLAND Egg Laying Competitions have once again demonstrated the prolificacy of Queensland poultry. This time the record was established at the Maryborough test by an Australorp hen, owned by Mr. N. D. Wilson. Unfortunately a full twelve months' record is not available, as the bird did not start to lay until nearly six weeks after the commencement of the test.

From the 1st May to the 28th February (304 days) 324 eggs were laid by this hen. Thus it is demonstrated that an egg a day is not the limit of the fowl. The production of this bird, during certain months, is of more interest than the total number laid, as will be seen from the following figures:—

Month.	Number of eggs laid.	Number of days when laying took place.
July	29	27
August	32	30
September	30	28
October	37	30
November	47	30
December	41	21

On the 29th December the bird went broody, but laid another 54 eggs during January and February, laying on fifteen separate days no less than two eggs.

Poultry-raisers may view with suspicion these figures. The writer is kept posted with the production of the birds in the various competitions and, owing to the remarkable performance of this hen, made arrangements for a departmental officer to visit the test daily for a short period and record the eggs. The honesty of the attendant was in no way questioned but, in order that the records would be beyond suspicion, the pen was sealed, and so arranged that an egg could not be placed in the secluded nest in which the hen regularly laid. Prior to this the hen had been noticed on frequent occasions to visit the nest twice daily.

The egg-size, even when two were laid, was up to the usual standard. The average egg, during the month of May, weighed 1¾ oz., and during June, 2⅛ oz.

I am of the opinion that in this case the hen had two ovaries and oviducts functioning. Under normal conditions, as breeders are aware, the right oviduct and ovary atrophy and disappear before the chicken is hatched. There are exceptions, however. Professor Rice has recorded the fact of a hen possessing two ovaries and oviducts, and that both were functioning. I have noted this on one occasion, and probably some breeders attending a demonstration on post mortem examination given to the National Utility Poultry Breeders' Association will recollect the finding of two oviducts in a White Leghorn hen; the specimen is here reproduced. The organs were not in full production state, but the plate indicates the possibility of this taking place.

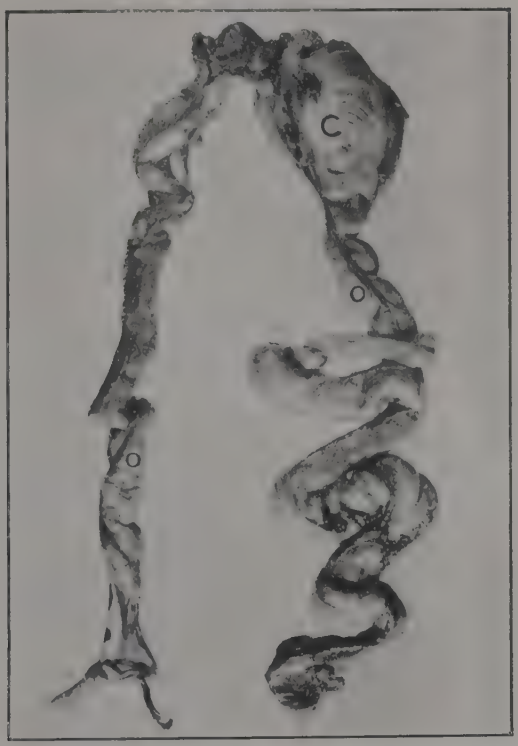


Plate 104.—This Plate Shows Two Partially Developed Oviducts Removed by Mr. Rumball from a White Leghorn Hen.

o. Oviduct. c. Cloaca.

QUEENSLAND SHOW DATES.

Childers: 2nd and 3rd June.
Marburg: 2nd and 3rd June.
Gin Gin: 4th to 6th June.
Wowan: 4th and 5th June.
Bundaberg: 11th to 13th June.
Gladstone: 17th and 18th June.
Lowood: 19th and 20th June.
Mount Larcom: 19th and 20th June.
Rockhampton: 23rd to 27th June.
Mackay: 30th June to 2nd July.
Kilcoy: 2nd and 3rd July.
Home Hill: 3rd and 4th July.
Townsville: 7th to 9th July.
Gatton: 8th and 9th July.
Woodford: 9th and 10th July.
Cleveland: 10th and 11th July.
Charters Towers: 15th and 16th July.
Caboolture: 16th and 17th July.
Rosewood: 17th and 18th July.
Ithaca: 18th July.
Laidley: 22nd and 23rd July.
Nambour: 22nd and 23rd July.
Esk: 24th and 25th July.
Ayr: 24th and 25th July.
Mount Gravatt: 25th July.
Bowen: 29th and 30th July.
Cairns: 29th and 30th July.
Maleny: 29th and 30th July.
Royal National: 10th to 15th August.
Crow's Nest: 26th and 27th August.
Wynnum: 28th and 29th August.
Imbil: 2nd and 3rd September.
Enoggera: 12th September.
Beenleigh: 18th and 19th September.
Malanda: 23rd and 24th September.
Brisbane River Camp Draft: 25th and 26th September.
Rocklea: 26th September.
Kenilworth: 26th September.
Southport: 3rd October.
Nerang: 9th October.
Evelyn Tableland: 9th and 10th October.

STOCK FOODS.

By J. C. BRÜNNICH, F.I.C., F.A.C.I., Agricultural Chemist.

PART I.

The wealth of our State is based to a very large extent on the number of our live stock, and the welfare of the stock again depends entirely on the feeding; therefore the question how, when, and what to feed is of greatest importance to farmer and grazier.

All our wool, meat, hides, dairy produce, eggs, and the labour performed by horses and cattle are the result of feeding. All our live stock can be regarded as living factories producing from the food consumed products useful to man.

As a large proportion of our stock in Queensland is pasturing on natural herbage, the feeding under normal conditions is therefore more or less outside the province of agricultural science; but in times of scarcity, which periodically occur, hand feeding must be resorted to, and at such times it is of the utmost importance to have some knowledge of the composition of various stock foods, which have to be used in connection with poorer roughage to keep stock in good condition.

In this paper Mr. Brünnich discusses stock foods and their values, and his notes will be accepted by readers as a valuable contribution to our information on important points in animal husbandry.

IT may be safely stated that at present, in the matter of feeding, local ideas are very elementary, or such mistakes would not be made as feeding starving sheep with chaffed sugar-cane, bought at an exorbitant price, considering that its food value is less than half that of poor bush hay, or a quarter of that of lucerne chaff. Professor Perkins drew attention to similar mistakes made in South Australia in 1914-15, when chaff was the most costly stock food on the market, and still it continued throughout to be most eagerly sought after, to the almost complete neglect of relatively cheaper concentrated foodstuffs.

Objects of Feeding.

The body of the young animal requires a sufficient amount of food to supply the materials necessary for its growth. But even during any part of the growing stage there is a continued breaking down and wearing out of all the tissues of the body, and this loss must be made up by the nutrients contained in the food to keep the animal in a normal healthy condition. Furthermore, food must be supplied to produce the energy for the carrying out of all voluntary and involuntary functions of the body. An animal working hard is using up a large amount of fat and muscle, but even an animal at rest requires food for the production of heat and other involuntary

functions of its body. Summarised the objects of feeding are as follow:—

(1) To maintain bodily heat;
(2) To repair waste tissues;
(3) To reproduce young;
(4) To form new tissues and organs;
(5) To perform muscular labour;
(6) To secrete various products;
(7) To lay up reserve stores.

Composition of Foods.

In order to get a clear insight into the art of feeding and carrying out of the objects above mentioned, we must understand the composition of the tissues that require building and renewing, and the composition of the foodstuffs available.

The composition of any stock food, analysed according to present conventional methods, is expressed as follows:—

Lucerne hay (in full flower) contains:

Moisture	10·0 per cent.
Crude protein	15·0 per cent
Crude fat	2·8 per cent.
Carbohydrates or nitrogen free extract, by difference	33·2 per cent.
Crude fibre	31·0 per cent.
Ash	8·0 per cent.
	100·0 per cent.

Putting these results in another form, we find—

I. Moisture		10·0 per cent.
II. Dry matter		90·0 per cent.
(A.) Ash or mineral matter		8·0 per cent.
(B.) Organic matter 82·0 per cent.	Proteins	15·0 per cent.
	Fats	2·8 per cent.
	Carbohydrates	33·2 per cent.
	Fibre	31·0 per cent

I. Moisture.—All foods contain a varying amount of water or moisture, even in apparently dry foods. In the animal body water constitutes about two-thirds of the body weight, and, as a rule, not sufficient water will be supplied by the food, and therefore an additional amount of water must be a separate part of the animal's food, and such water has to be of good quality, and not too saline.

The average amounts of moisture found in stock foods are as follow:—

Oil cakes, meat meals, &c.	6 to 10 per cent.
Grains, seeds, and meals	10 to 15 per cent.
Hay	8 to 12 per cent.
Grasses, ensilage	65 to 83 per cent.
Roots and tubers	70 to 90 per cent.

Stock foods which contain small amounts of moisture always keep better than moist foods, and foods containing large amounts of water should be cheaper than dry foods.

II. Dry matter of a food is the solid matter left after all the water has been driven off by artificial drying. The dry matter, on which

the actual food value of a stock food depends, can be separated by burning or ashing into—

(a) Ash or mineral matter; and

(b) Organic matter.

(A.) **Ash or mineral matter** comprises about 5 per cent. of the body weight of an animal, and has most important functions to perform, as it enters into the formation of bones and teeth, of blood, and other fluids of the body, and direct and control various life processes. The importance of ash in stock foods influencing the welfare of stock has already been dealt with in previous papers ("Queensland Agricultural Journal," March and April, 1926, and subsequently December, 1929, and January, 1930). The ash of stock foods should contain sufficient amounts of lime, potash, and phosphoric acid, and smaller amounts of iron, magnesium, soda, sulphuric and hydrochloric acid, silica, and traces of hydrochloric acid and iodine.

As many of our stock foods are deficient in certain mineral matter, they may be supplemented by giving the animals licks.

Excess of mineral matter, as found for instance in immature mangels and fodders grown on saline country, may cause trouble, just as an excess of salt in the drinking water may cause ill-health and even death of animals.

The amount of mineral matter in stock food varies with the stage of maturity, as some of the mineral matter is returned to the soil by the plants towards the end of the flowering and seeding stage of growth.

A liberal supply of mineral matter, more particularly lime and phosphoric acid, must be given to young growing animals, and at least double the amount of that actually required for the body should be supplied, as large amounts are wasted in the excreta. Mineral salts are also of the greatest importance to female animals during the periods of reproduction (gestation) and feeding their young (lactation).

A milch cow receiving a liberal ration of food which, however, was lacking in lime, continued, during a test lasting 110 days, to yield about 3 gallons of milk daily. The milk contained about ¾ oz. of lime, and a little over 1 oz. of lime was lost daily in the excreta and urine. During this trial the cow must have used up one quarter of the total amount of lime contained in her skeleton to make up for the lime deficiency in the food.

When making up rations the mineral matter of foods must be taken into consideration. All cereals and their by-products are low in lime. Legumes, like clover, lucerne, cowpea, field peas, &c., contain high amounts of lime. The amount of phosphorus or phosphoric acid is low in straw, chaff, potatoes, and other root crops, whereas large amounts are found in cereals, bran, oil cakes, meat, and fish meals.

The amount of mineral matter found in stock foods will vary considerably according to the quality of soil on which they were grown.

During the years 1910 to 1914 a large number of ash analyses were made in connection with an investigation of the food value of

various crops, and it is of interest to give a summary of the results of the analyses obtained, showing the variation of lime and phosphoric acid contents and the average amounts.

	100 LB. OF FODDER CONTAINS LB. OF—	
	Lime. CaO.	Phosphoric Acid. P_2O_5.
Wheat straw	0·22 (0·16/0·25)	0·11 (0·06/0·20)
Wheat hay	0·25 (0·20/0·32)	0·39 (0·30/0·48)
Barley hay	0·45 (0·35/0·50)	0·56 (0·47/0·59)
Cowpea hay	2·30 (1·70/3·02)	0·50 (0·33/0·62)
Field pea hay	2·40	0·36
Lucerne hay	2·00 (1·65/2·47)	0·56 (0·48/0·78)
Mitchell grass hay	0·52 (0·35/0·84)	0·34 (0·18/0·50)
Rhodes grass hay	0·50 (0·27/0·70)	0·57 (0·27/0·96)
Paspalum hay	0·50 (0·16/1·01)	0·38 (0·17/0·72)
Prairie grass hay	0·55 (0·20/0·90)	0·51 (0·18/0·81)
Summer grass hay	0·21	0·76
Couch grass hay	0·80	0·63
Green sorghum	0·20 (0·09/0·31)	0·12 (0·07/0·16)
Pumpkins	0·03	0·15
Mangels	0·03	0·09
Carrots	0·11	0·18
Mixed pasture hay	0·45 (0·30/0·57)	0·41 (0·18/0·65)
Wheat, grain	0·06 (0·03/0·08)	0·86 (0·34/0·96)
Bran	0·09	3·00
Pollard	0·08	2·10
Maize	0·02 (0·01/0·07)	0·70 (0·60/0·86)
Cotton-seed meal	0·36	2·60
Linseed meal	0·50	1·70
Cocoa nut oil cake	0·32	0·94
Sorghum ensilage	0·11	0·24

The younger the plant the more rapidly available is the ash for animal nutrition. During and after the flowering stage the silica contents increase rapidly, and the digestibility is much decreased.

Of the root crops, mangels contain, as a rule, more ash than swedes, and the large amount of lime sulphate in their ash is a drawback, as it causes bladder stone troubles with sheep.

The best utilisation of the mineral constituents of food is in laxative rations, and from 20 to 30 per cent. of the mineral matter is digested; the remainder is returned to the soil in the form of fæces and urine. If the ration is made costive, the digestibility of mineral matters is at once considerably lowered, even if present in large excess, and although the food remains a much longer time in the digestive tract than in the case of laxative foods.

The great value of bran, although relatively poor in the amount of ash it contains, lies in the fact of inducing laxativity of costive rations, thereby increasing the digestibility of mineral matter. The addition of any very fibrous food, like poor hay, straw, &c., causes a great decrease of the availability of mineral matters, and this is of particular importance in the case of all animals carrying or rearing their young. Hay exposed to rain will lose large amounts of mineral matter, and growth of any moulds will induce further heavy losses.

(B.) **Organic matter** is that portion of the food which burns when the material is strongly heated, and consists chiefly of compounds of carbon, hydrogen, and oxygen. These organic compounds were produced in the growing plants with the aid of sunlight from the carbonic acid in our atmosphere and water. The value of any stock food depends practically on the amounts and composition of this organic matter, which may be divided into **nitrogen-free compounds** and **nitrogenous compounds.** The latter, in addition to the three elements mentioned, contain nitrogen and small amounts of sulphur.

The actual composition of the organic matter is exceedingly complex, being formed of a very large number of organic compounds, but, for practical purposes, food analysis divides them into the following classes:—(1) **Proteins,** (2) **Fats,** (3) **Carbohydrates,** or as stated sometimes as **nitrogen-free extract,** and (4) **Fibre.**

(1) **Protein.**—The nitrogenous matters of the animal body, the major part being proteins, are found in the muscle, gelatinous parts of bones and tendons, brain, nerves, and other internal organs. Similarly in the stock foods the principal part of the nitrogenous material is protein. Various names have been in use, the compounds also being called proteids, albuminoids; but the name protein first proposed by Chittenden covers the whole class of these compounds. These compounds are some of the most complex organic compounds found in animals and plants, and contain carbon, 50.0-55.2 per cent.; oxygen, 19.0-24.0 per cent.; nitrogen, 15.0-17.6 per cent.; hydrogen, 6.5-7.3 per cent.; sulphur, 0.3-2.4 per cent.

In the conventional food analysis the total amount of nitrogen is determined, and the percentage of total nitrogen found is multiplied by 6.25, under the assumption that the proteins contain on an average 16 per cent. of nitrogen ($\frac{100}{16} = 6.25$), and the result recorded as **crude protein.** This amount of crude protein will, naturally, include various other nitrogenous compounds, possessing all different feeding value, and in more complete analyses the **true protein,** the actual **flesh-forming nutrients** of foods, is separately determined. Chief among the non-proteins are the **amides,** which are present to a greater or less extent in all foods, particularly in those of vegetable origin. The nutrient value of amides is similar to that of fat and carbohydrates. The value of protein is not restricted to the production of flesh, but

in case of any surplus can be utilised for the production of heat and work, or building up of body fat. Fats and carbohydrates, on the other hand, cannot replace proteins.

In the past century, during the time Liebig did important investigations in agriculture, only one protein was supposed to exist, but subsequent investigation made by a large number of scientists proved the existence of a large number of proteins, which differ from each other with regard to the **amino-acids** they yield when digested. Feeding experiments have also proved that all **the various amino-acids,** which make up the great number of proteins, **must be supplied** by the food for **complete nutrition.**

Whereas plants can build up, or synthesize, all the various amino-acids during their growth, animals cannot do so, and therefore the food they consume must supply all the nineteen or twenty amino-acids in proportionate amounts for the building up of the various proteins of their bodies, and consequently if only one of these amino-acids is lacking the animal fails to grow or thrive.

As a matter of fact the percentage of crude protein found by analysis in any food is by no means a sure guide for judging the actual nutritive value.

Thomas investigated the nutritive properties of the proteins of various foodstuffs in 1909, and introduced the term **biological value** of proteins, as measured by the percentage quantity of body proteins spared from loss by the ingestion of the proteins contained in the food.

The following values were obtained by him:—

Ox meat	104	Potato	79
Cow's milk	100	Spinach	64
Fish	95	Pea	56
Rice	88	Flour	40
Cauliflower	84	Maize	35

Later work by Robinson, in 1922, proved that the value of the proteins of cow milk was given far too high, and should be reduced to 51.

The high biological value of the proteins of rice and potatoes is of particular importance as the total amount of crude protein is only small in these important staple foods.

The importance of mixed diet or occasional change of diet is thus easily explained, to give a good supply of all the various amino-acids.

Of particular value for the maintenance and growth are **lysine** and **tryptophane.** It was observed by many experimenters that the nitrogen equilibrium was disturbed, when all proteins yielding tryptophane were kept from the ration, which then was rendered incapable of sustaining life, because tryptophane appears necessary for the normal functioning of the body, while a non-supply of lysine in the protein nutrients temporarily puts a stop to growth, and consequently to the proper utilisation of all the protein products. It was found that foods of animal origin like meat, milk, and eggs contain more of these important constituents than foods of vegetable origin, and for this reason a better rate of growth is obtained when part of the food ration is made up with meat or fish meal, and dairy products for pig-feeding. It is of interest to give a short table

published by F. E. Corrie, in the "Fertiliser, Feedstuffs, and Farm Supplies Journal," October, 1924, showing the various proteins in a number of substances, and the percentage of lysine in each of the proteins present.

Source of Protein.	Name of Protein.	Lysine per cent. in Protein.	
Cow's milk ..	Lactalbumin	9·16	
	Casein	7·61	(tryptophane 1·5 per cent).
Hen's egg	Albumin	3·76	
	Vitellin	4·81	
Bone, skin, &c. ..	Gelatin	6·00	
Beef	Protein	7·59	
Halibut (fish) ..	Protein	7·45	
Earthnut	Conarachin	6·00	
Peas	Vicilin	5·40	
	Legumin	4·98	
	Legumelin	3·03	
Kidney Bean ..	Phaseolin	4·58	
Soya Bean	Glycinin	3·39	
	Legumelin	4·91	
Maize	Glutelin	2·93	
	Zein	Nil	(tryptophane nil)
Wheat	Leucosin	2·75	
	Glutenin	1·92	
	Gliadin	Nil	(tryptophane nil)
Linseed	Protein	1·20	
Barley	Hordein	Nil	

The actual amount of lysine in some of the grains is very small; working the amount out for wheat, we find—

Proteins in Wheat.

Leucosin	0·4	per cent. with 0·011 percentage Lysine
Proteose	0·3	per cent. with ——
Edestin	0·7	per cent. with 0·015 percentage Lysine
Gluten—		
Gliadin	4·35	per cent. with ——
Glutenin ..	4·5	per cent. with 0·086 percentage Lysine
True proteins ..	10·2	per cent. with 0·112 percentage Lysine
Crude protein ..	12·1	per cent.

Maize contains only very small amounts of lysine as it is absent in its principal protein, the zein. Leguminous seeds like peas, beans, and earthnuts contain relatively large amounts.

Another important amino-acid is **Cystine,** which, according to the research work of Mr. H. R. Marston, reported in Bulletin 39 of the Council for Scientific and Industrial Research, forms 13.1 per cent. of the protein of dry, cleaned wood fibre.

As vegetable proteins contain, as a rule, but little cystine, generally under 1½ per cent., according to the statement made by the late Professor T. Brailsford Robertson (in the bulletin mentioned), **to produce 1 lb. of wool protein, or about 2¾ lb. of greasy wool, no less than 8 lb. of vegetable protein must be eaten by a sheep,** and the **carrying capacity of any country for sheep may very probably be determined by the capacity of its pasture plants to produce cystine.**

Some artificial foods—for instance, dried blood, some meat meals, wheat grain meal, and dried yeast—are comparatively rich in cystine,

and some feeding tests with small amounts of such foods have given very encouraging results with regard to increased wool production.

A few of the proteins are extremely poisonous, as for instance **Ricin,** the protein of the castor oil bean. The presence of a few castor oil beans in feed has caused the death of horses.

(2) **Fat.**—The non-nitrogenous part of the animal is chiefly fat, which is used in the production of heat and energy. The amount of fat in the animal varies more than any of the other substances, as it may be as low as 6 per cent., and rise to 30 per cent. and more. The fat is stored up in the animal body and is consumed as required if an insufficient amount of fat is supplied with the ration.

The term " fat " includes the butter-fat in milk, fat of meat, oil in seeds, wax in plants, &c. In food analysis the amount of fat is determined by extracting it from the dry material with ether or benzine, and, because small amounts of other substances not true fats are also extracted, we call the ether extract **Crude Fat.**

The fats of various foods have not an equal value for the production of animal heat and formation of fatty tissue, the oils from oil seeds and cakes having the highest value, followed by the fat in cereals and leguminous seeds; and the fats in coarse fodders possess the smallest value, being 2.4, 2.1, and 1.9, repectively, as compared with starch, taken as the unit. From these figures it will be seen that fat has practically more than double the value of starch or sugar for the production of heat, and is really the most concentrated of food nutrients.

(3) **Carbohydrates** are a typical vegetable product, found only in small amounts in the animal body. They are composed of the elements carbon, hydrogen, and oxygen, and the two latter always in the same relative proportion as found in water. Usually from 50 to 70 per cent. of the dry matter in stock foods consists of carbohydrates, in soluble and insoluble forms, but all are readily digested by the animals. The carbohydrates can be divided into three classes—

(a) Sugar, like cane sugar, fruit sugar, &c.;

(b) Amyloses, like starch, dextrin, &c.;

(c) Mucilaginous substances, like gum, &c.

The carbohydrates are transformed into other organic compounds, and stored up in the animal body; they also are readily oxidised, and the energy produced by this process of slow combustion is used to perform work and maintain animal heat.

In the practice of conventional food analysis the amount of carbohydrates, also called **nitrogen-free extract,** is generally found by difference.

(4) **Fibre.**—The material forming the cell walls of plants is a carbohydrate **cellulose,** which exists in different forms. For food analysis the **crude fibre** is determined by boiling the fodder with weak acid and with weak alkali solutions, followed by washing, drying, and ashing.

Only portions of this crude fibre can be digested by animals. Towards the ripening period of plants the fibre becomes more woody and less digestible.

In Table I., the composition of various stock foods, stating the percentage of these four principal food constituents, and also the

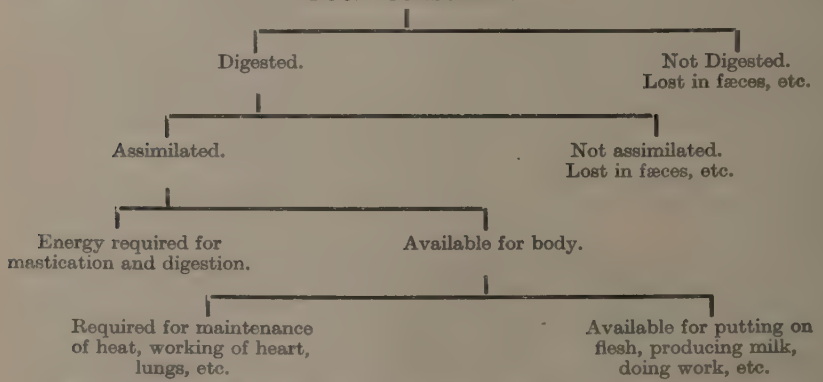
average amounts of moisture and ash they contain, is given in columns 1 to 5. The amount of total dry matter is easily obtained by subtracting the amount of moisture from 100.

In many cases the variation in the percentage amounts of protein, obtained from analyses of stock foods from all parts of Queensland, are shown by giving the minimum and maximum amounts found below the average amount.

Digestibility of Foods.

The chemical composition of the food, as represented by the amounts of crude constituents given in the first five columns of Table I., are not of much value unless the actual amounts of each of the constituents which can be made use of by the animal by the process of digestion are also known.

Let us consider first the actual **fate of the food,** after being consumed by the animal:—



This table shows that only a part of the food nutrients is really available for the main objects of feeding, and that a large portion is lost. The actual determination of the amount of food digested can only be found by a large number of carefully conducted experiments, in which the food material is analysed and weighed before consumption, and the weight and the composition of the animal excrement is determined, at the same time checking by weighing the body weight of the experimental animals. There exist, however, great practical difficulties in the carrying out of these experiments, and only a very small number have been made in Australia, so that we must take for the compilation of a table of **digestibility coefficients,** in most cases, the results of European and American experiments.

During the year 1920 we carried out some feeding experiments with sheep at the Yeerongpilly Stock Experiment Station, and we found in most cases a good agreement with the usually accepted values; the digestibility of protein and fat was lower in some of our fodders, whereas the digestibility of the crude fibre was in some instances, in lucerne, bush hay, bran, and pollard, distinctly higher, and this is probably due to the more quickly growing nature of our plants.

The digestibility of food is influenced by the age of the crop, the conditions of growth, the treatment of the crop at the time of harvesting, and lastly to a very large extent depends on the animal itself consuming the fodder.

From the moment the food is taken into the mouth up to the time it leaves the body continual changes take place. The food is first masticated, ground up into small pieces, and saturated with saliva. Ruminants, like oxen, cows, sheep, and goats, only roughly chew the food during the first mastication, as later on they regurge the food for more thorough mastication and salivation (chewing the cud). For this reason ruminants are able to digest a larger proportion of the nutrients contained in coarser and bulky foods than horses and pigs, which have only a simple stomach. In order to prevent horses eating concentrated foods like grain, oilcakes, &c., too quickly, a certain amount of chaff must be given at the same time to ensure proper mastication. For pigs, which as a rule chew their food very lightly, any hard or coarse food must be softened by being soaked, steamed or boiled, as, for instance, in the case of hard grains like maize.

During the process of digestion, which takes place first in the stomach and later in the intestines, the nutrients of the solid food are changed into soluble compounds which can be absorbed. During this process bacteria play an important part, more particularly in the digestion of fibre. The undigested residue of the food is from time to time excreted, and the time during which the food remains in the body depends on the amount of undigested matter and the size of the digestive organs. For ruminants, with an alimentary canal twenty to twenty-seven times the length of the body, it takes from three to four days. Pigs, with an alimentary canal fourteen times as long as the body, from thirty to forty hours, and with horses about twenty-four hours.

In Table II. the digestibility **or coefficients of digestibility** of the various nutrients of the stock foods, the percentage amounts of each of the crude nutrient digested is given, and the average values were used for the calculation of the percentage amounts of **digestible nutrients** contained in stock foods, given in columns 7 to 11 in Table I.

Nutritive Ratio.—We have already learned that the stock foods vary very much in their composition. All leguminous seeds, oilcakes, and meat meals contain a high percentage of protein and very little non-nitrogenous compounds, whereas grains and rootcrops contain large amounts of starchy matter with small amounts of protein. The proportion of these principal nutrients is called nutritive ratio or albuminoid ratio, or the ratio between the digestible pure protein and the sum of all the digestible non-nitrogenous nutrients. In the calculation the high amount of heat produced by fat is taken into consideration, and the formula is as follows:—

$$\text{Nutritive Ratio} = \frac{\text{Digestible pure protein}}{\text{Digest. fat} \times \begin{cases} 2{\cdot}4 \text{ for oil seeds and cake} \\ 2{\cdot}1 \text{ for cereals} \\ 1{\cdot}9 \text{ for coarse fodder} \end{cases} + \text{digest. carbohydrates} + \text{digest. fibre.}}$$

or generally expressed as—

1 lb. digest. protein ÷ — lb. digest. non-proteins (carbohydrates, etc.).

This nutritive ratio (column 12 in Table I.) must fall between certain limits in order that the food supplied to the animal does not lead to any waste and still keeps the animal in good health and condition. The ratio will be different for young growing animals and adult stock, and as a rule for the younger animal a smaller or narrower ratio is required, as in this case the chief function of the food is to build up tissues, for which purpose chiefly proteins are necessary.

Milk, which is the natural food of the young animal, has a nutritive ratio of 1 ÷ 4. As a rule, it may be stated that the young animals require a ratio of 1 ÷ 4 to 1 ÷ 5. For adult animals the ratio should be about 1 ÷ 6, and for the fattening of adult animals a much wider ratio of about 1 ÷ 8 or even more is required. Milking cows need a ratio from 1 ÷ 5 to 1 ÷ 5·4; a very heavy milker a ratio of 1 ÷ 4·5.

In the **chart** given in the appendix the position of all foods in regard to the average nutritive ratio of 1 ÷ 5 is clearly shown. All the foods above the line are rich in protein, and the foods below the line contain less protein, and must be mixed with the protein-richer foods to make standard rations.

Starch Equivalent.—In order to compare roughly the total heat-producing and fat-forming powers of stock foods, the value of starch equivalent was introduced, which expresses the amount of pure starch, equivalent to the sum of all the digestible fat-forming nutrients in each food.

The relative fat-forming powers of the various nutrients is, according to Kellner, as follows:—

1 lb. digestible fat	in oily seeds and oil cakes	= 2·4 lb. of starch
	in cereal and leguminous seeds	= 2·1 lb. of starch
	in coarse fodders (grass, hay, and straw) ..	= 1·9 lb. of starch
1 lb. of digestible carbohydrates and fibres		= 1·0 lb. of starch
1 lb. of digestible protein		= 0·94 lb. of starch

For exacting work a distinction should be made between maintenance starch equivalent and production starch equivalent, the former expressing the value of the food, equivalent to starch, necessary to maintain the animal at rest, without any gain or loss of weight.

The production starch equivalent, which is given in column 14 of Table I., takes into consideration the **value number** (V.) of foods (column 13 of Table I.), which expresses the percentage availability of the digestible nutrients in the stock food, with 100 being the maximum value.

Experiments have shown that most food stuffs have a food value below the expected value as calculated from the various digestible nutrients, due to the amount of energy wasted in the work of mastication and digestion. Wheat straw, for instance, is from 60 to 70 per cent. below the expected full value of 100, and, therefore, the value number is given as 30. As a rule, the low value numbers of all coarse foods are associated with the amount and quality of the fibre present.

The formula for the calculation of the **production starch equivalent per 100 lb. is as follows:—**

$$[\text{Digest. protein} \times 0{\cdot}94 + \text{digest. fat} \times \begin{cases} 2{\cdot}4 \text{ oil seeds} \\ 2{\cdot}1 \text{ cereals} \\ 1{\cdot}9 \text{ coarse fodders} \end{cases} + \text{digestible carbohydrates} + \text{digestible fibre}] \times V.$$

This calculated value of the production starch equivalent is the best measure for comparing various foods for the production of fat, milk, growth, and work.

The term starch equivalent, introduced by Kellner, is used by other authorities in several different senses, more particularly with regard to the actual heat produced by the slow combustion of the carbohydrates in the animal body.

The relative value of food may be based on its **thermal value** or its heat-producing power, expressed in terms of **calories.** The amount of heat required to raise the temperature of a unit of water (1 gramme) by 1 deg. C. is called a calorie. The following figures give the heat of combustion or calorific power of a few substance in calories:—

Amides (Asparagine)	3,500
Proteins (mean)	5,700
Carbohydrates (mean)	4,000
Vegetable oils and fats (mean)	9,300

The actual fuel value of any food can be determined by burning the substance in an apparatus, called a calorimeter, or can be calculated from the figures given above, if its composition is known. To make the figures conveniently small the term **Great Calorie,** equal to 1,000 calories, is used, and also the term **Kilo-pound-unit, Kt,** the amount of heat required to raise the temperature of 1,000 lb. of water from 15 deg. C. to 16 deg. C.

According to F. A. Murray ("Chemistry of Cattle Feeding and Dairying"), the total fuel value of meadow hay containing 2·5 per cent. crude fat, 10 per cent. protein, 42 per cent. carbohydrates, and 26 per cent. fibre is 3·64 Kt per lb.; which means that if 1 lb. of this hay is burned, enough heat is produced to raise the temperature of 3,644 lb. of water by 1 deg. C. This total fuel value, however, is not a true measure of the nutritive value of the food. Some parts are only partly oxidised, some of it is not oxidised at all and is excreted in faeces and urine, other parts again are lost in form of gases. Murray states for meadow hay the **actual available energy** is—

Food.	Dung.	Urine.	Gases.	
Kt.	Kt.	Kt.	Kt.	
3·65	— [1·61	+ 0·035	+ 0·173]	= 1·83 Kt.

This available energy may be used for the calculation of rations for stock. An ox of 1,000 lb. live weight requires about 35 Kt. of available energy supplied by the food. The amount of food is not directly proportional to the live weight of the animal; an ox weighing 1,600 lb. does not require exactly twice as much food as an ox of only 800 lb. weight, because the surface of the body, which is the cause of a great loss of heat by radiation, is not in direct proportion to the weight. Whereas an ox of 800 lb. weight requires 30 Kt., an ox of 1,600 lb. requires 48 Kt. All rations are usually calculated on 1,000 lb. live weight, and therefore if the weight of the animal is less than 1,000 lb., something must be added to the average ration, and when it weighs more than 1,000 lb. something may be deducted from the calculated quantities.

Food Units.—The market price of any stock food is by no means a measure of its relative feeding value. In normal seasons the market value of commonly used stock foods finds a level corresponding approximately to their feeding value, but in abnormal seasons many of the stock foods, on account of demand and scarcity, acquire quite exorbitant values. In order to approximately value stock foods and estimate the price of the food units per ton, the food units (column 15, Table I.) are calculated as follows:—

$$\text{Digest. crude protein} \times 2{\cdot}5 + \text{digest. fat} \times \left\{\begin{array}{l}2{\cdot}4 \text{ for oilcakes}\\ 2{\cdot}1 \text{ for cereals}\\ 1{\cdot}9 \text{ for coarse fodder}\end{array}\right\} + \text{digestible carbohydrates} + \text{digestible fibre}$$

By dividing the market value per ton by the number of food units we obtain the cost per unit.

Bran costing £10 per ton is a very expensive food, as with seventy-eight food units would give a cost per unit of $\frac{200}{78} = 2s.\ 6\frac{3}{4}d.$ The cost per unit was 1s. 11d. in 1919, and only 1s. 2d. in 1914.

The stockowner should therefore carefully compare food units and market price in order to buy stock food economically.

Other important factors influencing the value of stock foods are palatability and succulence.

Palatability is such an illusive subject that it cannot be accurately defined, but is greatly influenced by familiarity and habit or custom. Palatability has an influence on the digestion, but not necessarily all palatable foods are easily digestible, and animals may show likings for food very indigestible and even poisonous. Again, some foods particularly nutritious may be at first refused, but may eventually be readily eaten as soon as the animals get accustomed to it; best results with feeding will only be obtained by using such feeds which are palatable and readily eaten by the animals. Sudden changes of food must be avoided, and any changes by adding new foodstuffs must be very gradual.

Succulence.—The beneficial effects of succulent foods, like green pasture grass, silage, and various roots, has been amply demonstrated by scientific feeding trials and by practical common-sense experience on farms. Succulent feeds promote digestion and have a highly beneficial slight laxative action. A dairy cow can only give a maximum yield when supplied with a certain amount of succulent food. Succulent food is of particular importance for young animals to promote a rapid sturdy growth, but is just as essential to all stock, horses, pigs, and sheep.

Of great interest is the influence of radiation of various kinds, like the ultra-violet rays of sunlight, on the process of nutrition by direct action on the skins of animals, and also by action on the food itself. This action is closely correlated with the functions of certain vitamins.

All cereal grains, seeds of legumes, tubers, and edible roots are deficient in fat soluble A, lime, and salt, and their proteins are frequently of poor quality.

The palatable green leaves, although low in total amount of nutrients, are complete foods for all animals which are able to consume large quantities.

Vitamins.—The knowledge on this subject has made such rapid advance during the last few years that I cannot do better than give a summary published by Dr. E. Vanstone in "The Fertiliser Feeding Stuffs and Farm Supplies Journal" (vol. xiv., p. 10, 15th May, 1929).

The Nature of Vitamins.

Can you imagine young animals receiving plenty of food and yet making no growth? The food supplied was capable of providing the necessary amount of heat or energy; moreover, it was properly balanced —that is to say, it contained sufficient albuminoids and carbohydrates; also, it was not lacking in mineral matter. Yet the animals did not grow. A few drops of milk added to the food was sufficient to cause growth to take place, but with no milk there was no growth.

The milk contained in a few drops some substance essential for growth. The actual amount of food in the milk was extremely small,

and the amounts of the growth-promoting substances must have been still smaller.

The discovery of growth-promoting substances in milk was followed by the discovery of others in other foods, and at the present time six of these substances are known. They are called "**vitamins.**" Until more knowledge is obtained as to their nature they are distinguished from one another by the letters **A, B_1, B_2, C, D,** and **E.**

Vitamins not only possess growth-promoting qualities, but are capable of preventing certain diseases, such as scurvy, neuritis, and rickets. They make the animal less liable to bacterial infection and improve the breeding qualities. Since stock-rearing is one of the chief concerns of agriculture, facts concerning the growth of young animals, the production of meat and milk, and the health of animals are of great importance, and a knowledge of vitamins would appear to be essential.

Fat-Soluble and Water-Soluble Vitamins.

The six known vitamins can be divided into two classes. Three of them are found in foods in company with certain fats in which they dissolve; these three—namely, A, D, and E—are called "**fat-soluble vitamins.**" The remaining three—namely, B_1, B_2, and C—are usually found in watery foods and fruits. They are known as the "**water-soluble**" vitamins.

Fat-Soluble Vitamins A, D, and E.

Vitamin A.—This vitamin occurs in greatest quantity in cod liver oil, and also in egg yolks, ox fat, and butter fat. It is essential for growth. So far as present knowledge goes, it must be obtained from the food, since animals are not able to manufacture it in their bodies. Young animals have great need of it, and adult animals are able to store it. If the food of young animals is lacking in this vitamin, growth stops and the animal soon dies. With an adult animal, a lack of this vitamin makes it more liable to contract infectious diseases.

Farm Foods and Vitamin A.

This vitamin is found associated chiefly with animal fats, and not with vegetable oils. Oil-cakes and meals do not contain this vitamin in any appreciable amount. The animal must, therefore, obtain a supply from home-grown foods, and the chief source is **pasture grass.**

It has been shown that the amount of vitamin A present in milk is greatest when a cow is fed with green food, and is least on a ration of cereals and roots. The milk contained maximum amounts of vitamins A and D when the cow was on pasture. Addition of kale to a winter ration was found to increase the amount of vitamin A in the milk, and a similar effect was obtained by addition of cod liver oil in small amounts. Hay will contain less vitamin A than pasture grass, because this vitamin is destroyed by oxidation.

Winter Feeding of Dairy Cows and Vitamin A.

Evidence appears to be accumulating that high-yielding dairy cows after three or four years react to the tuberculin test, and their breeding qualities become diminished. This happens even when the rations are adapted to the milk yield and sufficient mineral matter is supplied. Is it not possible that a deficiency of vitamin A often occurs in the ration?

The high yield of milk means a high yield of vitamin A, which is present in the milk fat. It is known that the animal can store vitamin A and that milk in summer contains more vitamin A than milk in winter. The effect of the high milk production might be to use up slowly the animal's store of vitamin A, with the result that in a few years there is a greater liability to infection and a degeneration of the productive powers. The inclusion of a little cod liver oil in oil-cakes and meals would probably ensure a sufficiency of this vitamin.

The Ricket-Preventing Vitamin.

Vitamin D.—This vitamin is found with vitamin A in cod liver oil. It differs from vitamin A, however, in its ability to cure and prevent rickets and in the fact that it is not so easily destroyed by oxygen.

It is well known that a deficiency of minerals, such as lime and phosphoric acid, will cause rickets, but there may be a sufficiency of these minerals and an absence of this vitamin D, and under those circumstances the bones are imperfectly formed. The presence of this vitamin assists the animal in correcting any improper balance of lime and phosphoric acid. It also possesses growth-promoting qualities.

Vitamin D and Sunlight.

If two lots of animals are given the same food, which is deficient in vitamin D, and one lot is kept in the dark while the other lot is occasionally exposed to sunlight, it has been found that those in the dark develop rickets, but not those in the sunlight. The ultra-violet light may change a substance present in the body into vitamin D, and may also call up the reserves in the body of vitamin D.

Within the last few years the remarkable fact has been demonstrated that foods that do not possess ricket-curing properties can actually obtain them by exposing them to ultra-violet light, and they also acquire growth-promoting powers. In this way such foods as dried milks, olive oil, linseed oil, cotton-seed oil, meals, and flour, &c., can obtain ricket-curing and growth-promoting qualities.

The value of milk for curing rickets depends on the extent the cow is exposed to sunlight, as well as on the diet. The addition of cod liver oil increased the amount of vitamin D in the milk, and there was more vitamin D in the milk from cows on pasture. Dried summer milk contains more vitamin D than dried winter milk. It would therefore appear that there is less likelihood of a deficiency of this vitamin in the food than of vitamin A.

The discovery of this vitamin D and the researches that have followed have shown the importance of sunlight for the health of the animal.

Vitamin E (the sterility-preventing vitamin).—In the experiments on young animals given foods lacking in vitamins A and D it was frequently observed that the breeding powers were diminished. A deficiency of vitamin B was observed to affect the organs of reproduction in the male, while an addition of vitamin C to a diet in which it was lacking had the effect of increasing the number of litters. Thus a deficiency of any of the vitamins appears to affect considerably the reproductive powers.

Further investigation has shown that in wheat germs, oil, and in the green leaves of plants such as lettuce and lucerne there is a vitamin with marked anti-sterility powers. Unlike vitamins A and D, this

vitamin E is only present in very small quantities in milk fat and cod liver oil. Vitamin E differs from the other fat-soluble vitamins A and D in being able to withstand heat and air. Animals are able to store this vitamin and to draw on this store when the vitamin is lacking in the diet. At present our knowledge of this vitamin is scanty, but a wide field of investigation which is likely to lead to further discovery has been opened up.

Water-Soluble Vitamins B_1, B_2, and C.

Vitamins B_1 and B_2 (growth-promoting and neuritis-preventing).—The chief sources of these vitamins are the seeds of plants, eggs, and yeast. Fortunately, they are found in nearly all foodstuffs.

The water-soluble substances in yeast have been found to possess growth-promoting powers and an ability to prevent neuritis. Until recently a single vitamin called B was considered responsible for both functions, but evidence is accumulating showing that two substances, B_1 and B_2, are probably responsible. In the absence of this vitamin, young animals cease to grow almost immediately, showing that they cannot store this substance. It affects young and old animals. Birds kept on a diet lacking this vitamin become paralysed, but are rapidly cured if a little dried yeast is added to their food.

Vitamin C.—This vitamin is found in fresh fruits and vegetables. Oranges, lemons, tomatoes, and fresh green leaves contain good supplies. It does not occur in dried seeds nor dried fruits, since it is easily destroyed by oxidation. Thus it will be present in germinating seeds and in grasses, but not to any great extent in hay. Its most remarkable character is its power to prevent and to cure scurvy. Fresh green food should be given to young pigs in order to supply this vitamin and so enable the pigs to make satisfactory growth.

Significance of Vitamins for Agriculture.

It is not possible at present to say how much of any vitamin there is present in any feeding stuff. The most that can be said is that this or that food is rich or poor in a certain vitamin.

The water-soluble vitamins, which are growth-promoting and prevent scurvy and neuritis, are present in barley, oats, maize, peas and beans, bran and sharps, and swedes, so there is little danger of any lack of these constituents. We have seen that the important fat-soluble growth-promoting vitamin D, which is able to prevent rickets, can be produced by the sun's rays from other substances in feeding stuffs and in the animal.

The only vitamin that is at all likely to be somewhat lacking is the fat-soluble vitamin A, and then only when there is a deficiency of good hay or green fodder. Grasses and clovers are rich sources of practically all the vitamins. Oil-cakes are deficient in vitamins, but by the action of ultra-violet light can acquire the properties associated with vitamin D, the preventer of rickets, but not those associated with vitamin A.

Certain foods have obtained prominence as great sources of vitamins. Cod liver oil as a source of vitamins A and D. Yeast contains practically all the vitamins, and young stock receiving milk seldom fail to make good progress. Skim milk will, of course, contain less vitamin A.

In order to measure the effects of vitamins in foods on the live weight of animals it is necessary to experiment with animals that will show a quick response. This means that so far feeding experiments on small animals only have been carried out. Usually rats, mice, guinea pigs, and birds such as chickens and pigeons have been selected. It may therefore be questioned whether the results should be applied to farm animals. It is not doubted, however, that the facts are of great importance in the nutrition of human beings, both children and adults. Vitamins are prescribed by the medical profession and a large number of vitamin preparations are now sold.

While it is possible that in many cases the significance has been over-stressed, yet the facts should not be ignored. It is certain that farm animals need vitamins and get them in most cases, but occasions of vitamin deficiency may arise in feeding pigs, calves, and poultry, and also in the case of high-yielding dairy cows. It has been stated that sterility is as common among cows of average yield and low yield as with those giving high yields, and therefore cannot be due to deficiency of vitamins. The subject is, however, of sufficient importance to justify full investigation, and this could be done through the milk-recording societies.

Conclusion.

The growth of our knowledge of vitamins emphasises the importance of green foods for young stock and of good pastures for stock of all kinds. For the production of healthy animals making satisfactory live-weight increase, the food must be complete in albuminoids, carbohydrates, minerals, and vitamins.

Vitamins, mineral substances, and the other constituents of the foods are not independent, but mutually dependent. Only in exceptional cases, such as in the case of high-yielding milking cows, will there be likelihood of vitamin A shortage. Any deficiency can be remedied by the feeding of cod liver oil and dried yeast. Finally, sunlight is of immense importance to the wellbeing of the animal. It calls up reserves of vitamins and also manufactures more from other materials in the body.

Acknowledgment.

In compiling this article the writer has consulted the following:—

1. Recent Advances in Biochemistry, by J. Pryde, M.Sc.
2. The Abstracts of the Journal of the Chemical Society.
3. The Annual Reports of the Progress of Chemistry, published by the Chemical Society.

[TO BE CONTINUED.]

CLIMATOLOGICAL TABLE—MARCH, 1931.

SUPPLIED BY THE COMMONWEALTH OF AUSTRALIA METEOROLOGICAL BUREAU, BRISBANE.

Districts and Stations.	Atmospheric Pressure: Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·96	85	74	92	6	67	18	527	19
Herberton	..	81	64	93	7	58	7	138	14
Rockhampton	30·02	89	72	98	7	68	1, 28, 30	137	15
Brisbane	30·10	81	68	89	8	62	23	1492	24
Darling Downs.									
Dalby	30·08	84	63	94	8	51	22	223	9
Stanthorpe	..	77	58	89	9	46	29	187	13
Toowoomba	..	76	61	90	8	55	26	525	14
Mid-interior.									
Georgetown	29·90	97	69	101	8, 9	62	8	60	7
Longreach	29·94	94	71	106	9	59	22	359	7
Mitchell	30·03	85	66	97	9	53	23	339	10
Western.									
Burketown	29·90	93	76	103	8	68	22	41	7
Boulia	29·92	96	72	109	10	57	22, 23	247	4
Thargomindah	29·98	88	67	98	18	52	23	266	5

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MARCH, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING MARCH, 1931, AND 1930 FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Mar.	No. of Years' Records.	Mar. 1931.	Mar. 1930.		Mar.	No. of Years' Records.	Mar. 1931.	Mar. 1930.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	9·74	30	2·87	3·10	Nambour	9·32	35	13·86	7·72
Cairns	18·12	49	8·58	14·22	Nanango	3·46	49	5·25	1·42
Cardwell	16·02	59	8·95	7·64	Rockhampton ..	4·58	44	1·37	1·02
Cooktown	15·25	55	5·19	11·42	Woodford	7·98	44	12·18	4·00
Herberton	8·04	44	1·38	3·77					
Ingham	15·71	39	17·86	18·51					
Innisfail	26·61	50	7·60	38·03					
Mossman	17·43	18	..	14·91	*Darling Downs.*				
Townsville	7·45	60	4·60	1·02					
					Dalby	2·76	61	2·25	2·62
					Emu Vale	2·48	35	1·82	1·49
Central Coast.					Jimbour	2·63	43	2·40	3·18
					Miles	2·70	46	3·86	1·60
Ayr	6·76	44	5·10	0·66	Stanthorpe	2·70	58	1·87	2·30
Bowen	5·76	60	2·20	0·64	Toowoomba ..	3·81	59	5·25	1·68
Charters Towers ..	3·89	49	0·65	2·51	Warwick	2·56	66	2·40	1·25
Mackay	12·27	60	4·69	4·54					
Proserpine	12·44	28	5·43	7·01					
St. Lawrence	5·45	60	0·84	0·51					
					Maranoa.				
South Coast.									
					Roma	2·62	57	3·75	0·25
Biggenden	3·99	32	3·60	5·49					
Bundaberg	5·19	48	6·91	1·77					
Brisbane	5·82	80	14·92	2·85	*State Farms, &c.*				
Caboolture	7·62	44	15·13	4·30					
Childers	4·57	36	6·59	1·12	Bungeworgorai ..	1·54	17	2·67	0·22
Crohamhurst ..	11·30	38	18·43	7·25	Gatton College ..	3·20	36	4·30	2·56
Esk	4·92	44	4·80	2·87	Gindie	2·66	32	1·85	3·18
Gayndah	3·07	60	6·39	0·77	Hermitage	2·24	25	2·71	1·37
Gympie	6·23	61	9·75	3·06	Kairi	8·04	17	..	2·24
Kilkivan ..	3·90	52	8·36	1·99	Mackay Sugar Experiment Station ..	11·30	34	5·31	4·39
Maryborough ..	6·04	59	5·56	3·05					

GEORGE G. BOND, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—APRIL, 1931.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means. Max.	Shade Temperature. Means. Min.	Shade Temperature. Extremes. Max.	Date.	Shade Temperature. Extremes. Min.	Date.	Rainfall. Total.	Rainfall. Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·93	86	73	89	1, 2	67	20, 27	643	11
Herberton	..	78	61	87	2	53	30	215	11
Rockhampton	30·01	86	64	94	2	58	23	51	4
Brisbane	30·06	79	61	90	2	56	22	361	8
Darling Downs.									
Dalby	30·07	79	53	88	2	41	9	288	5
Stanthorpe	..	71	46	80	1	30	9	174	11
Toowoomba	..	72	52	81	1	43	3, 4	279	5
Mid-Interior.									
Georgetown	29·90	94	69	98	1, 2	57	26, 27	10	2
Longreach	29·96	88	62	98	1	50	4	116	2
Mitchell	30·04	80	52	91	1	41	9, 10	51	2
Western.									
Burketown	29·91	90	69	94	6	61	21	523	5
Boulia	29·96	87	63	99	1	52	5, 6	0	..
Thargomindah	30·04	78	59	90	1	48	4	88	3

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF APRIL, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1931 AND 1930 FOR COMPARISON.

Divisions and Stations.	Average Rainfall. April.	Average Rainfall. No. of Years' Records.	Total Rainfall. April. 1931.	Total Rainfall. April. 1930.
North Coast.	In.		In.	In.
Atherton	4·18	30	4·03	0·53
Cairns	11·57	49	12·00	4·73
Cardwell	9·01	59	6·04	1·01
Cooktown	8·77	55	6·52	1·90
Herberton	3·89	44	2·15	1·29
Ingham	8·03	39	9·87	3·64
Innisfail	20·12	50	20·01	5·81
Mossman Mill	8·59	18	6·20	1·15
Townsville	3·48	60	3·00	..
Central Coast.				
Ayr	2·62	44	1·67	..
Bowen	2·83	60	1·14	0·12
Charters Towers	1·60	49	0·67	0·11
Mackay	6·56	60	1·16	2·90
Proserpine	6·11	28	3·19	2·28
St. Lawrence	2·94	60	0·33	0·39
South Coast.				
Biggenden	2·15	32	2·38	0·76
Bundaberg	3·12	48	1·34	0·98
Brisbane	3·75	80	3·61	2·25
Caboolture	4·30	44	2·38	1·63
Childers	2·87	36	1·61	1·93
Crohamhurst	6·57	38	3·03	3·42
Esk	3·03	44	1·41	2·11
Gayndah	1·41	60	1·56	1·20
Gympie	3·40	61	1·57	1·06

Divisions and Stations.	Average Rainfall. April.	Average Rainfall. No. of Years' Records.	Total Rainfall. April. 1931.	Total Rainfall. April. 1930.
South Coast—continued:	In.		In.	In.
Kilkivan	2·23	52	1·64	2·22
Maryborough	3·75	59	2·89	2·70
Nambour	6·18	35	3·36	3·61
Nanango	1·90	49	1·71	0·72
Rockhampton	2·82	44	0·51	1·93
Woodford	4·49	44	2·05	1·66
Darling Downs.				
Dalby	1·33	61	2·88	1·98
Emu Vale	1·26	35	2·03	1·29
Jimbour	1·30	43	2·00	0·65
Miles	1·42	46	1·62	1·04
Stanthorpe	1·72	58	1·74	3·87
Toowoomba	2·54	59	2·79	2·58
Warwick	1·64	66	0·99	0·61
Maranoa.				
Roma	1·36	57	0·85	2·67
State Farms, &c.				
Bungeworgorai	1·32	17	0·74	2·02
Gatton College	1·85	36	1·47	2·71
Gindie	1·23	32	0·30	0·40
Hermitage	1·33	25	0·88	0·62
Kairi	4·03	17	..	0·12
Mackay Sugar Experiment Station	5·14	34	1·27	1·14

GEORGE G. BOND, Divisional Meteorologist.

FARMERS' SHEEP AND WOOL.

By J. CAREW, Senior Instructor in Sheep and Wool.

[*Continued from the April issue.*]

PART V.

This is the fifth article of a series planned for the purpose of supplying information sought from time to time by readers interested in sheep and wool; and also with the hope of stimulating interest in sheep-raising in Queensland on comparatively small holdings.

SHEEP EXPERIMENTS AT THE QUEENSLAND AGRICULTURAL COLLEGE.

EXPERIMENTS in sheep-raising were started at the Queensland Agricultural College, Gatton, in 1913, by Mr. John Brown, then Principal, who with Mr. W. G. Brown, formerly Sheep and Wool Expert of the Department of Agriculture and Stock, propounded the scheme and secured fifteen purebred rams, including five each of the following breeds:—Lincoln, Border Leicester, and Romney Marsh; also a flock of 500 large-framed Merino ewes.

The ewes were divided into three groups, and the rams were joined with them in February.

The result of this mating was a drop of 105.6 per cent. of lambs with the loss of one ewe.

When sufficient half-bred ewes were available, two rams each of the Dorset Horn, Shropshire, and Southdown breeds were mated with them.

When Mr. John Brown left the College, I, in collaboration with Mr. W. G. Brown, continued the experiments, chiefly to discover the influence of each of the long-wool breeds when mated with the Merino as regards quantity and quality of their respective wools, the suitability of the ewes of each cross for the purpose of forming breeders' flocks, and for the purpose of proving the relative rates of development of the lambs of each cross under similar conditions.

The experience gained led to the conclusion that the Lincoln was suitable as a first cross with the Merino, as the wool from the second cross was too coarse; and that the Border Leicester and Romney Marsh were suitable in both the first cross with the Merino and the second cross with the three respective crossbred ewes; and that the Dorset Horn, Shropshire, and Southdown were more suitable for mating with the crossbred ewes. The result of mating on these lines proved satisfactory and in the sales that followed as the result of the lambing the largest percentage of lambs as fat at 4½ months was taken from the Border Leicester crosses during the first week in December, and for which the highest prices were obtained, followed closely by the Dorset Horn in both the percentage as fats and the price realised.

When the third batch of lambs was sold all the crosses were represented, and the following prices, which can be taken as a fair comparative basis for all sales, were obtained. Border Leicester-Merino cross, 20s. 9d.; Dorset Horn-crossbred, cross, 18s. 4d.; Lincoln-Merino cross, 18s. 5d.; Romney Marsh-Merino cross, 18s. 4d.; Southdown-crossbred cross, 18s. 3d.; Shropshire-crossbred cross, 18s. As this was the first sale in which the Lincoln and Romney Marsh crosses were submitted, their lambs really represent five weeks extra time to all the other crosses. In the season under review, 1915-16, several lambs were slaughtered for home consumption. The selections were from the different crosses in the proportion as selected for sale.

On the 8th February, 1916, six wether lambs, the best of those remaining after four batches had been sold, were picked out for a killing test.

They were penned up for thirty-two hours, weighed separately, killed and dressed. Following are the details:—

Cross.	Live Weight.	Offal.	Skin.	Blood.	Dressed Weight.	Value.	
	lb.	lb.	lb.	lb.	lb.	s.	d.
Lincoln x Merino ..	78 ..	22 ..	14 ..	3 ..	37 ..	25	6
B. Leicester x Merino	80½ ..	23½ ..	13 ..	3 ..	41 ..	27	0
R. Marsh x Merino ..	78½ ..	22 ..	12½ ..	3 ..	41 ..	26	9
D. Horn x crossbred	77 ..	23 ..	10½ ..	3 ..	40½ ..	25	6
Southdown x crossbred	74 ..	21 ..	9½ ..	3 ..	40½ ..	24	6
Shropshire x crossbred	75 ..	22 ..	10 ..	3 ..	40 ..	25	0

The valuation is based on flesh and skin value at 6d. per lb., and is for comparative purposes only.

Sheep as Scavengers.

In the course of the season that Mr. G. W. Brooks was Acting Principal at the College 200 tail end wethers, road travelling for grass, were purchased. For three weeks they were used as scavengers on an old cultivation paddock, and at the end of that time several were good enough to be picked out for College consumption. In seven weeks from the time of purchase, half the mob were sold in Newmarket as fat wethers, which proved that sheep can be fattened quickly while doing useful scavenging work.

Breeding Results.

From the six breeds of rams and three crossbred lots of ewes, eighteen grades and crosses of lambs were produced. On the results achieved, Mr. C. Potts, the then Principal, decided to eliminate the Shropshire and South Down rams, because the Dorset Horn showed a better percentage in the earlier sales and realised a higher price on each occasion. The Romney Marsh was used for mating with the Merino ewes only, as they did not prove as suitable as the Border Leicester for the production of early lambs. The Border Leicester continued to be used in mating with both Merino and crossbred ewes with satisfactory results.

The result of the shearing proved that the Lincoln rams averaged 20 lb., the Border Leicesters 13 lb., the Romney Marsh 11½ lb., the Dorset Horns 6 lb., Shropshires 5½ lb., and the Southdowns 5 lb. per fleece.

The average weight per fleece of the Merino flock for one season was 7½ lb.

The Lincoln-Merino cross breeding ewes averaged 9½ lb., and Border Leicester and Romney Marsh crosses 8 lb. each. These experiments were continued until 1923 (when I left the College), and resulted in the following average details being secured:—Average lambing over five years, 78 per cent. Average losses with those mated with the Lincoln, 2 per cent. and all other breeds 1 per cent.

For comparative results during one season the wether lambs from the Merino ewes were selected when the oldest lambs were 5 months old and sold at Newmarket. The mob comprised 65 per cent. Border Leicester-Merino cross lambs, which averaged 23s. 7d. per head. The Romney Marsh-Merino cross, 20 per cent., averaged 22s. 6d. per head, and the Lincoln Merino cross, 15 per cent., averaged 22s. 3d. per head. The second mob was selected six weeks later. The Lincoln-Merino cross totalled 4 per cent. and averaged 17s. 6d. per head. The Border Leicester-Merino cross, 35 per cent. of the total number, averaged 20s. 3d. per head. The Romney Marsh-Merino cross provided 25 per cent., and averaged 19s. 10d. per head.

When the first lot was selected for sale six lambs from the crossbred ewes were selected for slaughter. Three Border Leicester-crossbred cross ewes, and three Dorset Horn-crossbred cross ewe lambs were enclosed for twenty-four hours before slaughter and dressed 41 lb. and 39 lb. respectively.

Many lambs from the same flock were shorn and held for ration purposes. When fourteen months old, the Dorset Horn hoggets dressed up to 63 lb. and the Border Leicester crosses to 65 lb. Corriedale rams were introduced, but their progeny did not mature as quickly as any of the other crossbreeds under review.

From comparisons obtained during the period, very little could be said in favour of either the Border Leicester or Dorset Horn crosses for killing purposes, but the Border Leicester cross had the heavier fleece and was easier to handle, being without horns. Both were fossickers of the first order, but on several occasions the Dorset Horn crosses were found with their horns caught in the netting fences.

The Farmer's Flock.

In going over the whole period it was observed that the half-bred Lincoln-Romney Marsh and Border Leicester ewes, proved most satisfactory and should be suitable under similar conditions as farmers' breeding flocks. The Border Leicester, although a long-wool breed, did in every case compare favourably with the Dorset Horn in producing early maturing lambs.

The Dorset Horn made a better showing than either the Shropshire or Southdown rams in mating with crossbred ewes as regards early maturity, relative weight of carcase, and the prices realised in the open market. But the carcase of the Southdown crossbred lamb when dressed was more attractive. For rearing lambs in the coastal area any of the three crosses used was more suitable as breeders than the Merinos, excepting as regards mating, for the majority of the long-woolled crossbreds come into season in the autumn only.

The second week in February was the earliest that a successful mating could be expected in normal seasons. By allowing rams to remain with the ewes from then to the end of March lambing will terminate at the end of August. It is advisable in fat lamb raising to keep rams away from the ewes, except during the mating season.

Ewes do not require luscious feed prior to lambing, but should have a paddock sufficiently big and good enough to carry them through the lambing period without having to change them. As soon as the lamb is dropped it can with its mother be put on the best that is available, which will enhance the flow of milk and give the lamb a good kick off, which means so much to its future development. Crossbred ewes are more conveniently worked in this respect than the Merino. A crossbred ewe with a lamb may be drafted away from a mob and driven through a gateway on her own, but the Merinos do not adapt themselves to this treatment so readily. The Merinos usually feed in a mob or strung out in a continuous line. The crossbreds feed in more scattered groups with a wider spread. If handled properly they will not run together when going through them on inspection. Therefore, one may ride, drive, or walk through them (whichever is customary) and so get a better opportunity of viewing them individually.

When lamb marking takes place, which should be when the lambs are from two to six weeks old (the younger the better), it is best to erect a temporary yard in the paddock where they are pastured. This will be found more convenient than driving them to and from the ordinary yards, unless conveniently situated. Temporary yards are not likely to be germ infested.

A crossbred ewe at eighteen months—or even before that age—may be mated successfully.

Difficulties.

The chief difficulties met with during my time spent in connection with the College experiments were:

(1) *Dry Spells.*—After a long dry spell feed in the paddocks available to sheep was scarce, for the paddocks were fully stocked and the sheep had limited scope, running about two sheep to the acre or more. Ensilage made from sorghum or maize stalks chaffed up was the usual feed given to them at the rate of about ½ lb. a day at the start, and increased gradually until about 1½ lb. a day was supplied. This, with a good supply of water and pickings in the paddock, kept them going, especially if they were put onto it before they got too low in condition.

Four months was the longest period that they had to be fed, and on this occasion a little whole maize was sprinkled on the ground, which proved very beneficial.

When ensilage was first put out they would not take to it; this difficulty was overcome by sprinkling a little good lucerne chaff over it, then mixing the chaff in through it for a few days, after which no further trouble was experienced.

Regularity of feeding was one of the chief things necessary.

(2) *Hard, Dry Grasses during Winter and Early Spring.*—This on forest country in the coastal areas where frosts are severe can certainly be regarded as being very much against successful sheep-raising. No winter herbage or clover makes its appearance, so that if a paddock is eaten out before the winter no improvement can be looked to until moisture and heat exercise their influence in spring. The most successful method was to reserve an area to see the ewes through the lambing, and to grow a winter crop or run them on an old lucerne or cultivation paddock.

(3) *Dogs and Foxes.*—Usually the domesticated dogs were the most troublesome at the College. They appear to have a natural tendency towards sheep, first in

play, but in all cases finishing up in wounding them. Sheep make good game for sport, and after once drawing blood dogs become very destructive, and no owner relishes the idea of supplying mutton worth 6d. per lb. to stray mongrels, but when it comes to several sheep being destroyed to supply one feast their depredations become serious and poisoned baits are the most reliable means of checking the evil. Foxes among the young lambs are very destructive, but they are usually easily poisoned. If dogs, foxes, and dingoes are in evidence the only safeguard is a dog-proof fence.

(4) *Blowflies.*—This is a troublesome pest, but in small flocks there should be no losses.

Sheep, if blown, are easily detected and should be treated without delay. A garden spray pump attached to a cask containing a strong sheep dip solution was used to jet all the sheep, and this kept them free for some time.

A careful lookout was always kept for "struck" sheep, and when found they were crutched and swabbed, or jetted.

(5) *Stomach Worms.*—When first I took charge of the flock, stomach worms were causing losses, especially among the weaners. Drenching was resorted to. The second drench was given eight days after the first. They were then put into a different paddock. A month later two more drenches were administered. Two of these drenches were bluestone and mustard and two arsenic and epsom salts. After these four drenchings we had the sheep much improved, and had control of the worms.

Ewe weaners unable to walk to the yards were drenched where they lay, and five out of the number were included in the breeding flock. These were drenched several times each year and had reared five lambs each and then fattened for the butcher. Although the whole flock was drenched regularly each year, no deaths occurred from drenching.

Breeding ewes were drenched three weeks before lambing and showed no ill effects. Needless to say, they were handled carefully both in the yard and when under treatment.

(6) *Fencing.*—Where sheep are kept they should be secured with sheep-proof fencing and gates. There were several lines of 7-ply cyclone wire mesh which made a good sheep-proof fence; two barb wires on top made a splendid stock fence, which should last for years. Some of the fences, reliable enough when feed was plentiful, were useless when the grass was scarce and short.

Reasons for Success.

The success achieved in these experiments, to my mind, puts the matter of breeding sheep at the same distance from the coast in a position well past the experimental stage. Under similar conditions that prevail at the College (which is about 50 miles away from the coast) I can say, with confidence, that sheep can be raised successfully and profitably if healthy sheep of the right breeds are introduced and properly treated. At the College different crops were grown for sheep feed, which resulted in fattening all lambs at or before six months at the prices quoted and higher. Ten acres of rape fattened at the rate of 26 sheep to the acre as well as keeping 50 pigs going during that time, and for some time after the sheep were taken off.

Old lucerne, wheat, oats, barley, sudan grass, and panicum paddocks all gave good results, but the two great factors in favour of cultivated areas are: (*a*) That lambs are kept growing without a check; and (*b*) that cultivation destroys all worm parasites so that the lambs are healthy throughout.

Should it be desired that the lambs only have access to the growing crop, provision may be made for communication by placing revolving bars, so set apart as to allow the lambs to pass through, while the heavier framed mothers are prevented from doing so. The lambs soon become acquainted with the opening, and may be drafted through as they develop. The lambs should be allowed to remain with the mothers until ready for market. The type of lamb desired for export is that which develops into a plump, symmetrical carcase which will dress from 33 to 40 lb. at five months.

If the lambs are kept going on good food they should be sappy and show plenty bloom at this age.

Pure bred rams of the proper type are an important factor in achieving success in fat lamb production.

Old ewes intended to be culled for age should be especially branded at mating time, fattened and sold with the lambs.

QUEENSLAND DAIRY HERDS.

PRODUCTION RECORDING.

List of cows tested by officers of the Department of Agriculture and Stock and qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn, the Jersey, and the Ayrshire Cattle Societies of Queensland. The final tests of these cows were carried out during the months of January and February, 1931. (273 days period unless otherwise stated.)

Name of Cow.	Age.	Milk Production.	Butter Fat.	Sire.	Dam.	Owner.
				JERSEY.		
		Lb.	Lb.			
Glenview Sultane of Brooklands	Junior (2 years)	5,039·4	265·184	His Majesty of Dalebank	Noble Sultane of Brooklands	F. P. Fowler and Sons, Coalstoun
Glenview Mascot of Sunnymeade	Junior (2 years)	4,400·25	256·439	Canon 3rd of Clydebank	Mascot 3rd of Sunnymeade	F. P. Fowler and Sons, Coalstoun
Hope of Hazeldean	Junior (2 years)	4,683	267·221	Lindley Bright Lad	Lindley Lady Viola	A. Bulow, Mulgeldie
Kelvinside Lady Charlotte	Junior (2 years)	4,377·05	235·011	Kelvinside Benedistine's Nobility	Charlotte of Kelvinside	J. and R. Williams, Glencliffe
Inasfayl Primrose Lady	Junior (3 years)	5,662·4	315·961	Norwood Model	Innisfail Primrose	McGeehan Bros., Kairi
Silver Lily of Woodstock	Senior (2 years)	5,665·5	267·277	Manager of Woodstock	Lily of Woodstock	P. C. Henman and Sons, Mudgeeraba
Bonnie Star of Lisieux	Senior (2 years)	5,835·518	338·678	Vera's Aureum of Pine Park	Bonnie of Southport	J. Williams, Wondai
Golden Chain of Burnleigh	Senior (2 years)	4,444·75	261·162	Trinity Baron	The Endless Chain	C. F. Klaus, Mundubbera
Trinity Popcorn	Mature	7,971·75	402·066	Cinder Duke	Oxford Barleycorn	J. Sinnamon, Moggill
Trinity Barleycorn 2nd	Mature	8,711	426·697	Clair Val Hero	Ferns Barleycorn	J. Sinnamon, Moggill
Onkaparinga Lady Jane	Mature	8,719	444·001	Oaklands Cream Lad	Stamford Lady	J. Sinnamon, Moggill
				AUSTRALIAN ILLAWARRA SHORTHORN.		
Bella 14th of Fairlie	Junior (4 years)	10,693·425	430·233	Dividend of Rosenthal	Bella 4th of Fairlie	Pledger and Dodd, Broadwater
Nita 8th of The Cedars	Junior (4 years)	11,587·27	444·397	Red Knight of Greyleigh	Nita 3rd of The Cedars	W. J. Barnes, Cedar Grove
Cherry 4th of Glenthorne	Mature	12,775·278	456·353	Pride of Glenthorne	Cherry 2nd of Glenthorne	A. J. Caswell, Wangaipong
Rene of Hilltop	Senior (2 years)	7,783	305·073	Beauty's Lad of Hillview	Irene of Hilltop	G. Heading, Murgon
Irene 2nd of Headlands	Junior (2 years)	8,748·122	313·17	Duchess Jellicoe of Fairfield	Irene of Hilltop	G. Heading, Murgon
Champion 10th of Oakvilla	Junior (2 years)	8,576·912	342·324	Victory of Greyleigh	Champion	W. Marquardt, Wondai
Wunulla Carnation 5th	Senior (3 years)	10,051·693	398·696	Starlight of Sherwood	Wunulla Carnation 2nd	J. A. Bradley, Goomeri
Vera 2nd of Fairfield	Mature	14,863·5	562·865	Fairfield of Fairfield	Vera of Fairfield	C. O'Sullivan, Greenmount
Linnette 13th of White Park	Junior (4 years)	11,777·5	408·882	Violet's Emperor of Hillview	Linnette 5th of White Park	W. T. Savage, Barnesmore
Pendant 6th of White Park	Junior (4 years)	7,515·625	371·805	Violet's Emperor of Hillview	Pendant of White Park	W. T. Savage, Barnesmore
Mona 4th of White Park	Senior (4 years)	9,345	363·997	Violet's Emperor of Hillview	Mona of White Park	W. T. Savage, Barnesmore
Olive 5th of Greyleigh	Mature	10,733·683	435·551	Foch of Greyleigh	Bella 2nd of Greyleigh	M. C. Lester, Laidley
Bella 10th of Kilburnie	Senior (4 years)	12,518·25	523·618			Macfarlane Bros., Radford
Scarlet of Trevor Hill	Junior (2 years)	8,117·458	330·188	Prince of Braemar	Star of Trevor Hill	G. Gwynne, Umbiram
Blossom of Trevor Hill	Senior (2 years)	6,886·121	312·37	Prince of Braemar	Lena 2nd of Trevor Hill	G. Gwynne, Umbiram

QUEENSLAND DAIRY HERDS—*continued.*

PRODUCTION RECORDING—*continued.*

Name of Cow.	Age.	Milk Production.	Butter Fat.	Sire.	Dam.	Owner.
				AUSTRALIAN ILLAWARRA SHORTHORN—*continued.*		
		Lb.	Lb.			
Starlight 2nd of Beechwood	Junior (4 years)	7,698·4	346·704	Royal Lad of Blacklands	Starlight of Beechwood	F. W. Woolley, Moregatta
Rosetta 8th of Glenthorne (230 days)	Mature	10,185·375	351·534	Duke of Burradale	Rosetta 4th of Glenthorne	W. J. Kajewski, Gowrie Junction
Grannie 20th of Thornleigh	Junior (2 years)	6,085·527	235·727	Terry of Thornleigh	Grannie 16th of Thornleigh	Queensland A.H.S. and College
Red Duchess 2nd of Kelston	Mature	13,259·5	551·317	Rooseveldt 2nd	Red Duchess of Jinbiggaree	A. Frank, Boonah
Diana 11th of Kelston	Mature	14,069·5	533·631	First Warrior of the Cedars	Diana 7th of Jinbiggaree	A. Frank, Boonah
Dulcie of Lynfield	Junior (2 years)	6,097·4	259·049			F. E. Birt, Sexton
Molly 4th of Upton	Mature	10,786·125	393·868	Red Rose of Hillcrest	Molly 2nd of Upton	W. J. Barnes, Cedar Grove
Cherry 13th of Glenthorne	Junior (3 years)	8,034·6	294·964	Douglas of Grasmere	Cherry 6th of Glenthorne	T. Shuttlewood, Peachester
Belle 8th of the Cedars	Mature	10,516	355·3			Hickey and Sons, Wilston
Ivo of Dualwon	Mature	8,824·225	352·238	Governor of Valley View	Ivy	A. J. Caswell, Wangalpong
Red Rose of Glengallon	Junior (4 years)	9,645·25	399·11	Jellicoe of Blacklands	Lassie 2nd of Glengallon	A. M. Bowman, Kin Kin
Plume 2nd of Waughope	Junior (2 years)	5,892·25	275·497	Royal of Glenburn	Plume of Waughope	A. M. Bowman, Kin Kin
Ettie of Iroquois	Senior (3 years)	8,104·467	352·55	Monarch of Sunnyside	Countess 2nd of Iroquois	H. Welch, Proston
Tibby of Iroquois	Senior (3 years)	6,840·375	307·656	Monarch of Sunnyside	Bubbles of Iroquois	H Welch, Proston
Model 3rd of Railway View	Mature	10,512	366·966			A. T. Waters, Lanefield
Gem 2nd of Hillvale	Senior (3 years)	8,913·625	404·784	Drafter of Greyleigh	Gem of Thorndale	H Welch, Proston
Cherry 4th of Bri Bri	Junior (2 years)	6,557·705	266·015	Lord Brilliant of Bri Bri	Cherry of Bri Bri	W. Middleton, Cambooya
Florrie 4th of Beechwood (259 days)	Senior (2 years)	6,717·55	290·075	Royal Lad of Blacklands	Florrie of Beechwood	F. W. Woolley, Moregatta
Mabel 3rd of Beechwood	Junior (2 years)	6,240	284·241	Royal Lad of Blacklands	Mabel 2nd of Beechwood	F. W. Woolley, Moregatta
Cherry 6th of Glenthorne	Mature	10,571·75	426·457	Duke of Burradale	Cherry 3rd of Glenthorne	W. J. Kajewski, Gowrie Junction
Topsy 6th of Werona	Senior (2 years)	8,217·302	319·91			J. W. Johnston, Wooroolin
Empress of Werona (365 days)	Mature	11,346·018	433·823	Young Kitchener of Burradale	Empress of Waughope	J. W. Johnston, Wooroolin
Bella 8th of Thornleigh	Senior (2 years)	6,456	268·381	Recruit of Thornleigh	Bella 6th of Thornleigh	Queensland A. H. S. and College
Perfect of Hill Top	Mature	10,018·329	460·527	Red Robin of Greyleigh	Doris of Springdale	G. Heading, Murgon
Beryl of Kiora	Mature	9,997·67	403·299	Red Knight of the Cedars	Beryl 3rd of the Cedars	W. J. Barnes, Cedar Grove
Tiddlewinks of Fairfield	Mature	11,141·125	357·318	Fairy's Renown of Fairfield	Marie of Fairfield	C. O'Sullivan, Greenmount
Champion 7th of Oakvilla	Senior (2 years)	9,039·221	369·186	Victory of Greyleigh	Champion 2nd of Oakvilla	W. Marquardt, Wondai
Silky 10th of Burradale	Senior (2 years)	9,193·45	366·59	Justice of Burradale	Silky 5th of Burradale	T. Shuttlewood, Peachester
Lovely 3rd of Loomhurst	Junior (2 years)	8,921·25	293·897	May Boy of Glenthorne	Lovely of Strathobi	T. Shuttlewood, Peachester
Jenny 6th of Waughope	Junior (2 years)	6,981·95	288·234	Royal of Glenburn	Jenny 2nd of Waughope	Mrs. A. Bowman, Kin Kin
Nellie 3rd of Sunnyview	Mature	14,056·8	574·711	Diamond of Greyleigh	Nellie of Bangalow	W. H Thompson, Nanango
Queenie of Glendalough	1 year 10 months	10,944·5	374·104			Hickey and Sons, Wilston
				AYRSHIRES.		
Fairview Bonnie Girl	Junior (4 years)	9,920·975	361·356	Beryl's Jock of Crescent Farm	Bonnie Jessie of Fairview	J. H and R. Andersen, Southbrook
Fairview Opal (270 days)	Senior (2 years)	9,475·75	346·377	Fairview Jeannette's Masterpiece	Orphan Girl of Fairview	J. H and R. Andersen, Southbrook

FRUIT GROWING IN NORTH QUEENSLAND.

Mr. R. M. King, Acting Minister for Agriculture and Stock, has made available the subjoined report by Mr. H. J. Freeman, Senior Instructor in Fruit Culture, on fruit-growing matters in North Queensland during the first four months of the current year.

THE weather for January, February, March, and April was reasonably good, but, considering these months should cover the recognised wet season for North Queensland, it could not be said that an excessive quantity of rain was registered. January had seventeen wet days with 1,742 points, February had fifteen wet days with 1,460 points, March had twenty-two wet days with 858 points, April had seventeen wet days with 1,200 points, making a total of 5,260 points for the four months.

Citrus Fruits.

Some very fine citrus fruits are being marketed from most of the orchards in the North. Local prices are not the best, but the bulk of the fruit railed to other centres is realising good money. At present there are three difficult propositions to handle in the consigning of citrus fruits from the North to the Southern markets, namely:—

1. The tremendous damage that the fruit-fly does. These growers do not fully realise the harm and loss occasioned by this very serious pest.

2. There is every need for a more systematic method of packing, entailing the abolition of the "flat packer," the clipping of all fruit from trees and grading and wrapping the fruit and making a reasonably tight pack.

3. A little better knowledge of marketing conditions in the South is necessary to enable one to understand what is readily saleable and how, by being so, to enable quicker distribution. The local method of selling is absolutely no guide whatever to the methods adopted in the bigger markets.

Pineapples.

Pines at present are very scarce; the odd small consignments being sold on the local market are demanding a reasonably good price. The weather evidently suits their growth admirably, for the pineapple plantations throughout the district all look particularly well.

Other Fruits.

An exceptionally fine crop of granadillas is at present being harvested, though unfortunately a fairly large percentage of the fruit is peculiarly formed, being quite restricted in the waist, this being due perhaps to physiological conditions pertaining at the actual time of the setting of the fruit.

Papaws are very plentiful, consequently prices are low.

Passion vines have given good crops, particularly off young vines, older vines being affected by a fungus trouble attacking the main stem just below the surface of the ground.

Recent consignments forwarded to the South fully establish the fact that a definite increase in the Northern banana industry is taking place. Total railage of bananas for January, February, March, and April from stations between Cairns and Townsville are 10,339 cases, approximately.

Tomatoes.

Local grown tomatoes are still very scarce; various wilts and blight are responsible for this condition, for to attempt to grow tomatoes commercially in this area, without very carefully spraying or dusting as a preventive against these troubles, is more or less a wasted effort.

All things being considered, the progress being made is reasonably good. Were it not that a general financial stringency exists throughout, the amount of fruit marketed over the past four months would have yielded returns that most decidedly would have been satisfactory.

Plenty of good land is available and transport conditions are much improved. Growing, packing, and landing the fruit on the individual markets in such condition that it meets with a ready sale must be the object of every grower. Fruit-fly in citrus, and rust and leaf-spot in bananas, if unchecked, is disastrous, and it behoves every grower to do his very utmost in an effort to combat these diseases, easily the three worst, as far as North Queensland is concerned.

THE COTTON INDUSTRY.

A DEPUTATION of members of the Queensland Cotton Board, comprising Messrs. D. C. Pryce, F. A. Kajewski, H. R. Brake, J. Beck, C. H. Bradley, and J. Bryant, R. J. Webster (manager), and Messrs. J. Harding and A. Hodgetts, representing the cotton growers, waited on the Minister for Agriculture (Hon. H. F. Walker) recently for the purpose of discussing with him certain matters relevant to the cotton industry.

Importation of Cotton Seed.

Mr. Pryce, chairman of the Cotton Board, mentioned that, in a former discussion with the Minister, the Board had recommended the introduction of cotton seed of some of the more earlier maturing varieties, the intention being to introduce several tons of seed of suitable varieties from the United States of America, but it was understood that when the Minister approached the authorities at Washington they were adverse to the importation of comparatively large quantities of seed, and suggested that a quantity of approximately 2 lb. of cotton seed from each of several varieties be imported. The introduction of further varieties of cotton seed was a burning question with the growers, and they did not appear to appreciate the proposition the Cotton Board were faced with in connection with the matter. The growers held the opinion that the Cotton Board had not shown any enthusiasm in carrying out their wishes in respect to the cotton seed importations, but were definitely of the opinion that the introduction of increased varieties would be of material assistance to them in establishing the industry in Queensland.

The Minister stated that he could assure the growers that the Cotton Board members had presented a strong case in favour of the importation of additional varieties of cotton seed, and he had visited the principal cotton-growing districts, and was convinced that the introduction of further varieties would be of material advantage, and probably lead to the ultimate selection of varieties that would suit the varying conditions of soil and climate over which cotton was grown in Queensland. The Minister had, however, been informed of the risk that was attendant upon the introduction of large quantities of cotton seed, and the danger of disease or pests being distributed through the medium of the seed being planted throughout the cotton-growing areas. He asked that the subsequent speakers would confine their remarks to the matter of the risk that was associated with the introduction of any large parcels of cotton seed.

All of the other gentlemen on the deputation spoke in support of the advantage to be gained by the importation of cotton seed of additional varieties. It was stated that the importation of cotton seed hulls had been permitted by the Federal authorities, and it was argued that there would be no greater risk in importing the cotton seed than would be incurred in introducing the hulls. It was also mentioned that while the Durango cotton had shown itself to be quite satisfactory in some districts, it did not thrive so well in other areas and locations. Cotton growing had extended over a large area of the State, and it did not appear to the deputation that a single variety of cotton would be found suitable to meet all the conditions of locations, climate, and soil.

The Government Guarantee.

Reference was made during the discussion to the action that had been taken by the Government in guaranteeing the amount required for the purchase of the plant from the British Australian Cotton Association by the Cotton Association. This action had been instrumental in placing the industry in a position to engage in the ginning of cotton and the utilisation of the by-products, such as the expression of oil from the cotton seed and the production of cotton seed meal. The industry, however, had to accept the responsibility of payment for the interest and redemption upon the moneys advanced. Additionally, the bounty granted by the Federal Government will be on a reduced scale after the 1932 season, and for these reasons it was necessary that every effort should be made to place the industry on a satisfactory basis without undue delay.

Cotton Varieties.

Mr. Wells stated that, as a result of the overtures that had been made some time ago relative to the introduction of further varieties of cotton, nine different varieties had been introduced, and these included several of the varieties that had been recommended by Mr. Webster subsequent to his visit to the United States of America. Of these nine varieties, three showed promise of being useful to the industry here. It was too early to give any definite information as to the yield and quality of these cottons, and he could not go beyond giving an expression of opinion as to the behaviour of these cottons in the test plots at present. Mr. Wells mentioned that he had some years ago recognised that the matters now mentioned by the Board would assert themselves at a comparatively early stage in the cotton-growing industry in Queensland, and, in anticipating the present difficulty, he had attempted to meet the position and had tried to get supplies of suitable varieties of cotton. He had persevered with the breeding-up of the Lone Star, Lightning Express, and Acala varieties in addition to Durango. He did not expect that Durango would prove itself to be the best cotton for growing throughout the whole of the cotton areas. Field tests had been carried out with the other varieties mentioned above, and in certain localities and soil types encouraging results were being obtained, and arrangements were being made for the more extensive use of these varieties where conditions of soil and climate seemed favourable. Given average seasonal conditions and yields, he anticipated that in the 1932-33 season there would be sufficient seed supplies to plant up some thousands of acres.

Other Matters Discussed.

The chairman of the Cotton Board also informed the Minister that, as a result of a levy imposed by the Board, certain moneys had been collected, and growers had asked the Board to issue to them scrip, with a face value equal to the amount of the deduction made from the individual growers on account of the levy.

Another matter which the Board would like to bring under notice was the payment of the amount due to the Board under the guarantee given by the Government to the growers of cotton covering the 1930-31 season cotton crop.

MINISTER'S REPLY.

The Minister, in reply, stated that he wished to congratulate the members of the Board and the growers' representatives on the able manner in which they had presented their case. He was sorry that he could not meet the Board and grant their request forthwith. He had made it a practice since he occupied the position as Minister of Agriculture to, as far as practicable, allow those engaged in primary industry to work out their own destiny. In this particular case, however, he was confronted with the possibility of the introduction of further disease and insect pests, and he did not wish to take any action that would in later years menace the industry. He had to rely upon and follow the advice of his own advisory officers on matters of this character, and he felt that no member of the deputation, were he placed in the position of Minister for Agriculture, would do otherwise than he had done. He would cause further inquiry to be made into the matter and would obtain further opinion and would advise them in due course. They could rest assured that he was extremely anxious to help the growers and the industry generally, and if a satisfactory reason for so doing could be devised he would take suitable and necessary action. The proposal of the deputation to the effect that the Government should arrange for the importation of a complement of 5 tons each of four different varieties of cotton seed was attendant with very grave risk to the industry as a whole, and he felt sure that they appreciated the necessity of his exercising very considerable precaution before introducing even comparatively small parcels of cotton seed, and proportionately with the bulk of seed imported the seriousness of reducing disease was correspondingly enhanced.

In respect to the issue of scrip to growers in recognition of the amounts collected by the levy, he would give this matter his consideration and inform them later in connection therewith.

In regard to the guarantee from the Government to the growers, he wished to inform the deputation that before payment for the amount due could be arranged, it was necessary that an officer of the Audit Department should make audit of the accounts of the Cotton Pool Board and make report to the Government. This report had only reached him the day before, and he would place the matter before Cabinet, and at an early date the Board would be further advised on the matter.

Answers to Correspondents.

BOTANY.

The following answers have been selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.:—

Spear Grass—Low Grazing Value.

J.B. (Jimbour)—

The grazing value of the Spear Grasses (*Aristida* spp.) is very low, except perhaps in their very young stages. Some species are somewhat better than others, but after the very young stages they soon become unpalatable and innutritious. The best of all the Aristidas is *Aristida leptopoda*, a big-growing species common on the Downs country.

Tie Bush (*Phyllanthus brisbanicus*).

G.B. (Gympie)—

1. *Wickstraemia indica.* A species of Tie Bush, so called on account of the tough, fibrous nature of the bark. This shrub has been accused of poisoning stock at different times, but feeding tests carried out at Yeerongpilly some years back gave negative results, though at the conclusion of the experiment the calves fed on it were in very poor condition. They rapidly recovered, however, on being put on to ordinary feed.
2. *Phyllanthus brisbanicus.* Common in the North Coast country, and generally growing in shady places on the edges of standing scrub, also as secondary growth. It is quite common, but we have not heard a local name given to it. It is not known to possess any poisonous or harmful properties.

Scrub Panicum (*Echinochloa*).

C.G.P. (Clermont)—The specimens have been determined as follows:—

1. *Setaria australiensis*, sometimes known as Scrub Panicum. It is closely allied to some of the Millets, such as the Manchurian Millet and Italian Millet grown in Queensland, also the crop grown here under the name of Panicum.
2. *Echinochloa crus-galli.*
3. *Echinochloa colona.* Both species of *Echinochloa* are widely spread over the warm parts of the world, and some species in India and Africa are much cultivated as grain crops. In Queensland the well-known fodders—White Panicum and Japanese Millet—belong to this genus, and the two species you send are looked upon as probably wild parents of these cultivated forms.

We would be glad of any other grasses you care to send at any time with the interesting notes attached.

Tournefortia Tree (*Cordia subcordata*).

F.R. (Rockhampton)—The specimens have been determined as follows:—

1. *Tournefortia argentea*, the Tournefortia Tree. This tree is one of the outstanding trees of the islands of the Capricorn Group and is referred to in most books and articles dealing with that particular region. In addition to Queensland, it has a very wide distribution over the sea-coasts of the Malayan region and the islands of the Pacific.
2. *Cordia subcordata.* A shrub or small tree found along the coast of Queensland and New Guinea, but one for which we have not heard a common name. It is quite ornamental and worth growing on this account. In addition to Queensland and New Guinea, it extends over the islands of the Pacific, and is found in some parts of the Malay Archipelago.

Most trees and plants of tropical shores have a wide distribution, their seeds being adapted for carriage by water.

Algaroba Bean.

C.A.U. (Manyung)—

The specimen is *Prosopis juliflora*, the Algabora or Mesquite Bean, a native of the Southern United States and Mexico, now widely planted in tropical and sub-tropical countries as a combined shade and fodder tree. Seed has been imported by the Department of Agriculture at various times and distributed to different farmers, particularly in Northern and Central Queensland. The pods are looked upon as being very nutritious and a valuable food for stock, and the flower as a valuable honey producer.

Yams.

J. O'R. (Yatala)—

It is rather difficult to name specimens from the yam alone without any indication as to whether the plant is cultivated or native, but we should say the one you send belongs to *Vitis opaca*, a common vine in coastal Queensland. It is not a member of the true yam family. Sometimes the yams it produces are very large, but we seem to have no record of their being eaten by the natives. They are sometimes eaten by pigs, and are said to give a pink colour to the flesh when the pig is killed, but of this we have no proof.

Jack Bean.

A.K. (Kapaldo, Monto Line)—

The bean you describe we have no doubt is the Jack Bean, *Canavalia ensiformis*, a bean grown fairly extensively in different tropical countries, but only to a very limited extent in Queensland. Personally, we have grown it and used the very young beans sliced in the same way as French Beans, and the fully formed but yet green seeds in the same way as Lima Beans or Broad Beans, and have found both very good eating. We do not know why the bean has not taken on more extensively, but people are rather chary of it as it does not agree with all stomachs and, therefore, before eating the beans in large quantities it is just as well to cook and taste discreetly.

Johnson Grass.

W.T. (Eidsvold Line)—

The specimen is Johnson Grass (*Sorghum halepense*), a perennial grass allied to Sudan Grass, Imphee, and other sorghums cultivated in Queensland. It has some value as a fodder, but, like its allies, contains a prussic acid yielding glucoside, which sometimes causes trouble. On this account the plant should preferably be wilted in the sun before it is fed to stock. The grass also becomes a great pest in cultivation, and it is very difficult to eradicate once it gets a hold. Taking everything into consideration, the demerits of the grass outweigh its merits, and it is not worth bothering about as a fodder grass.

Pennyroyal.

W.A.A. (Esk)—

The specimen in *Mentha satureioides*, the native Pennyroyal. Oil of Pennyroyal is a well-known abortifacient, and therefore it is quite likely that the present plant would be injurious to cows in calf if eaten by them in any quantity. The plant is very common in grass lands in Southern Queensland and no actual cases of these causing trouble of this kind have come under our notice.

Tick Trefoil.

J.A.P. (Kairi, N.Q.)—

The specimen is a species of Tick Trefoil (*Desmodium triflorum*), a plant that seems to have increased very much of recent years in the paspalum pastures of coastal Queensland. It has valuable feeding properties, but grows rather close to the ground and so does not make any great bulk of feed. The name "Tick Trefoil" comes from the fact that the pods break up into little pieces which are readily carried about on the feet of animals, on clothing, &c.

Flame Tree.

J.P.R. (Port Douglas)—

The specimen is the Flame Tree, *Sterculia acerifolia*, a native of Queensland and Northern New South Wales. It is one of the most beautiful of our native flowering trees and is readily propagated from seed. The seeds are borne in large, blackish, boat-shaped pods and are comparatively large and easy to germinate. The wood is very soft and has no commercial value as far as we know.

Control of White Ants Attacking Living Trees.

"ANXIOUS" (Charters Towers)—The Chief Entomologist, Mr. Robt. Veitch, advises:—

For the eradication of white ants attacking living trees, two suitable control measures are available. The first consists of the use of a poison syrup, made up according to the following New South Wales formula: 4½ lb. of molasses or treacle and 1¼ lb. of sugar are added to a solution of ¼ lb. of sodium arsenite in half-pint of boiling water. This poison syrup is then plastered on to two small pieces of soft pine board, which are then nailed or tied together, with the treated surfaces facing each other. This poisoned bait is then buried in the ground at a short distance from the tree requiring protection. The second control measure is the use of paradichlorobenzene as a soil fumigant. A trench, 3 or 4 inches deep, is dug round the trunk of the tree, not closer than 6 or 7 inches from the base of the trunk. The paradichlorobenzene is then scattered in the shallow trench, and the soil is replaced. The chemical should not be placed in contact with the roots. The amount of chemical to be used will vary with the size of the tree, and also with its state of health. In the case of young trees in a sickly condition, ½ oz. would probably be a safe dose. Larger and healthier trees may receive an application of 1 oz., or even as much as 2 oz.

Tobacco.

"Inquirer" (Warrego)—

A copy of a pamphlet on the subject of tobacco growing, which will provide you with full information in respect to the cultivation of the crop, has been posted to you. While the tobacco plant can be grown in almost any soil and under varied climatic conditions, the production of leaf satisfactory from a manufacturer's standpoint is limited to certain classes of soils, in districts where climatic conditions are favourable. The soils considered most suitable are well-drained light, friable, sandy to sandy loams, of a foot and over in depth, containing upward of 75 per cent. of fine sand, together with silt and organic matter, and preferably not more than 7 or 8 per cent. of clay. Lightness of colour in such a soil, suggestive of a low content or absence of oxides of iron and a consequent production of a high percentage of the brightest leaf, is preferred.

The average rainfall during the usual growing period—through portion of December and the whole of January, February, and March—should be between 15 and 30 inches, light falls at short intervals being preferable to heavier falls less frequently. Towards the end of March and during April, when the leaf is ripening, fine weather should prevail, much rain at this period exerting an adverse influence on leaf, colour, and texture.

At the present time the demand exists wholly for bright tobacco leaf, cured by the flue-curing process, which entails considerable expenditure in the erection of special buildings. Manufacturers refuse to purchase leaf cured by any other process.

As a result of tests carried out in North Queensland by this Department, in collaboration with the Australian Tobacco Investigation, principally at the Mareeba Tobacco Experiment Station, justification is felt in definitely recommending the production there of bright tobacco on a commercial scale. The Government has already made available an area comprising twenty-four farms. These have been taken up by various settlers and crops have been produced thereon during the season just terminated. Unfortunately the growers had to contend with an abnormal season, the rainfall during the growing period being just about half of the average for that particular district, taken over a period of thirty-four years.

Designs are now being prepared of a further area of approximately 100 farms in the vicinity of Mareeba, and it is anticipated that full particulars of these and conditions of settlement will be made available by the Land Administration Board at an early date.

Tobacco experiments, under the direction of the Australian Tobacco Investigation with this Department acting in co-operation, have been carried out also in the Central division of the State, and small flue-curing barns have been erected at Sarina, Rockhampton, and Miriam Vale for the purpose of curing the leaf raised in experimental areas situated in those localities.

The commercial culture of tobacco leaf in the Central division will be dependent largely on the results of these experiments.

In addition to the experiment work referred to in the Northern and Central divisions, good crops of tobacco leaf have been produced by private individuals in various districts, including Bowen and Harvey's Range, near Townsville. The experiment work has not so far been extended to the Southern division of the State, and consequently prospective growers are advised to confine their initial attempts at tobacco production to small experiment areas, situated in localities having conditions of soil and climate approximating to the general directions outlined in the literature issued by this Department.

The planting of seed may be made in the spring after all danger of frost has passed, or in the early summer, according to the rainfall of the district concerned.

This Department has made arrangements for supplies of seed whereby it is hoped that fresh stocks of various varieties will be available about August next.

Soil Conditions.

A.C. (Wamuran) in quest of information on a local soil condition, writes:—

The soil in question is only a small area and has been under bananas for some nine years. Red soil, northerly slope. There has been, from time to time, banana (bunch) stalks and waste fruit, &c., thrown onto the area. Banana bunches are large, also the plants; but when about six weeks from maturity the leaves die off a little and the bunches snap off at the throat of the plant. I have observed the same occurrence in old plantations. Beetle is present only slightly, and leaf-spot is not severe at all. I am inclined to think a light application of phosphoric acid might rectify the trouble—bone dust for instance.

The Agricultural Chemist, Mr. J. C. Brünnich, advises:—

This failure is a clear case of badly balanced constituents in the soil or malnutrition of plants. The soil in the locality is not very fertile, and even the best of soils would, after nine years' cropping without artificial fertilizers, show a falling-off in production. It will be very difficult to bring such neglected soil back into a state of fertility. The use of bone meal or lime would be quite useless, as banana plants require very little of either.

The land should be deeply cultivated, subsoiled, and left under lantana or pigeon peas for a year or two, and then planted again, with a heavy application of complete artificial fertilizers.

The fee for soil analysis is 10s. 6d. cash, and the specimen must be taken as an average sample of the area, soil should be taken from four to six places to a depth of 12 inches. If an analysis is required, forms and instructions would be forwarded on application.

Poultry Foods—Cowpea, Balanced Ration.

A.C. (Wamuran) asks—

1. What is the relative value of the cowpea as a grain for fowls in comparison with other grains?

2. What is necessary to balance the ration for laying fowls?

The Poultry Expert, Mr. P. Rumball, advises:—

Although cowpea has a very high protein content and therefore appears to be of greater advantage as a food than, say, wheat or maize, poultry, as a rule, do not relish the grain. Peas are better fed as part of the mash supplied to poultry, rather than as a grain, and then it is questionable whether to exceed 10 per cent. of the ration. They generally have a slightly bitter taste and, consequently, do not add to the palatability of the food.

Pamphlets on poultry-feeding giving information on balanced rations have been posted direct.

General Notes.

Dairy Produce Act—Examinations.

The 25th July next has been fixed for the holding of the annual examinations in the theory of milk and cream testing, milk grading, cream grading, butter making, and cheese making. Applications must be lodged before the 7th July, accompanied with the necessary fee of 5s. for each subject.

New Bird and Animal Sanctuaries.

His Excellency the Governor in Council has approved of the issue of an Order in Council declaring part of Cooroorah Station, Blackwater (Emerald district), and the Oakey Creek Water Supply Dams, near Mount Garnet, North Queensland, to be Sanctuaries under and for the purposes of the Animals and Birds Acts, in which it shall be unlawful for any person to take or kill any animal or bird.

Egg Board.

The election of growers' representatives to the Egg Board resulted as follows:—

District No. 1 (Bundaberg to Caboolture)—
Ronald Benjamin Corbett, Woombye. Returned unopposed.

District No. 2 (Redcliffe-Brisbane North)—
Arthur Alfred Cousner, The Gap .. .. .. 96 votes
Matthew Hale Campbell, Albany Creek .. .. .. 42 votes

District No. 3 (Brisbane South to Cleveland)—
Tom Hallick, Mount Gravatt. Returned unopposed.

District No. 4 (Moreton District)—
Nomination incomplete.

District No. 5 (Darling Downs)—
Francis Bell Common, Toowoomba. Returned unopposed.

Five representatives are required to hold office for one year as from 1st May, 1931.

Messrs. Corbett, Cousner, Hallick, and Common are eligible for appointment.

The appointment of the representative for District No. 4 is a matter for decision by the Minister for Agriculture and Stock (Hon. H. F. Walker).

Messrs. Corbett, Hallick, and Common were Board members for the twelve months ended 30th April, 1931.

Sugar Assessments.

The Governor in Council has approved of the issue of an Order in Council, under "*The Regulation of Sugar Cane Prices Acts, 1915 to 1922*," fixing the assessments on every ton of sugar-cane received at any mill after the 29th April, 1931, at 1½d. per ton. This is the same as last year.

The Minister for Agriculture and Stock (Mr. H. F. Walker), acting under the provisions of "*The Sugar Experiment Stations Acts, 1900 to 1923*," has approved of the levying of an assessment of ½d. per ton on all sugar-cane received at sugar works during the season 1931-32. This is the same as last year.

The Minister has also approved of the levying of assessments for the purposes of the various Cane Pests Boards for the season 1931-32, as follows:—

Plane Creek Cane Pests Board.—On every ton of sugar-cane received at the Plane Creek Sugar Works during the season 1931-32, an assessment of 1d. per ton, which is the same as last year.

Tully Cane Pest Destruction Board.—On every ton of sugar-cane received at the Tully Sugar Works during the season 1931-32, an assessment of 3d. per ton. Last year the amount was 2d.

Lower Burdekin Pest Destruction Board.—On every ton of sugar-cane received at the Pioneer, Kalamia, Inkerman, and Invicta Sugar Works during the season 1931-32, an assessment of 1d. per ton. This is the same as last year.

South Johnstone Cane Pest Destruction Board.—On every ton of sugar-cane received at the South Johnstone Sugar Works during the season 1931-32, an assessment of 3d. per ton. This is the same as last year.

Staff Changes and Appointments.

The resignation of Mr. A. C. H. Gibbs as an Acting Inspector of Stock at Roma has been accepted.

Mr. C. J. J. Watson, of Chelmer, Mr. A. J. Boyce, of Dunk Island, via Townsville, and Mr. F. C. West, General Manager of the Oakey Creek Tin Mines, N.L., Cairns, have been appointed Honorary Rangers under "*The Animals and Birds Acts, 1921 to 1924.*"

Constable Edward Kinbacher, of Baralaba, has been appointed an Inspector under and for the purposes of the Slaughtering Act.

Constable Eric Victor Thornton, at Gregory Downs, has been appointed an Inspector under the Slaughtering Act.

Mr. Fredrick A. Davis, of Woonon Holding, Sarina, has been appointed an Honorary Ranger under the Animals and Birds Acts.

Constable John Nally, of Edmonton, has been appointed a Slaughtering Inspector, as from 16th May, 1931.

Messrs. J. A. Kelly, F. Roberts, and W. E. Bindley, of the Mount Crosby district, have been appointed Honorary Rangers under the Animals and Birds Acts.

Mr. John Ries, of Burrum, has been appointed an Honorary Inspector under the Diseases in Plants Acts.

Mr. James Campbell Baker has been appointed Chairman of the Isis and Childers Local Sugar Cane Prices Boards.

Mr. Hugh Henry has been appointed millowners' representative on the Tully Local Sugar Cane Prices Board.

Mr. Charles H. C. Ross has been appointed canegrowers' representative on the North Eton Local Sugar Cane Prices Board.

The appointment of Mr. W. D. Lewis as an inspector under the Diseases in Plants Acts has been confirmed as from the 14th August, 1930.

In order to prevent the further wanton destruction of bird life in the Hinchinbrook shire, the following persons resident in the district surrounding Ingham have been appointed honorary rangers under the Animals and Birds Acts:—L. Nazzari, H. E. Hollins, B. A. Lynn, E. L. Burke, H. Gillis, H. C. Heard, G. Biggs, R. B. Blackburn, G. Geeson, F. Russo, G. Cantamessa, R. Russo, H. F. Hecht, E. D. Row, T. Stallan, R. Kirkwood, G. W. C. Warren.

Animal and Bird Sanctuaries—

Fairfax and Hoskyns Islands, situated in the Bunker Group, about thirty miles east of Bustard Head (county of Flinders,(parish of Bunker) have been declared to be sanctuaries under the Animals and Birds Acts, in which it shall be unlawful for any person to take or kill any animal or bird.

Constable S. V. Noonan, of Einasleigh, has been appointed a slaughtering inspector as from 23rd May, 1931.

Mr. Frederick J. Walsh, clerk in the dairy branch of the Department of Agriculture and Stock, has been appointed also an inspector under the Dairy Produce Act.

Mr. Wallace Thistlewaite, of Grantham, has been appointed an honorary ranger under the Animals and Birds Acts.

Butter Board.

The time fixed for the lodging of a petition on the question of the continuance of the operations of the Butter Board for a further term of three years closed at the Department of Agriculture and Stock recently, and, as no petition was received, the Board will continue to function for a further term of three years as from 1st July next.

Nominations for the election of six members for the full term have been received as under:—

District No. 1.—Sydney Harold Cleminson, Malanda, and William James Sloan, Malanda.

District No. 2.—James Lockie Wilson, Calliope.

District No. 3.—James McRobert, Maryborough, and George William Young, Inverlaw, via Kingaroy.

District No. 4.—James Purcell, Toowoomba, and Wilfred Adams Russell, Dalby.

District No. 5.—Charles Henry Jamieson, Tent Hill.

District No. 6.—Thomas Flood Plunkett, Beaudesert.

The date fixed for the return of the ballot-papers to the Returning Officer is the 29th June next.

Arrowroot Board.

The Governor in Council has approved of the issue of an Order in Council empowering the Arrowroot Board to have control of arrowroot flour. A Notice of Intention to make the Order in Council was issued on the 12th February last, and a petition for a poll to make the Order was called for. A petition was received, and the result of the subsequent referendum, conducted on the 15th April, showed ninety-three votes for and thirty-five against the placing of arrowroot flour under the control of the Arrowroot Board. As a 60 per cent. majority in favour was obtained, the Order in Council has accordingly been issued.

Destruction of Brumbies.

The Diseases in Stock Act Amendment Act passed last session of Parliament provided, among other things, for the destruction of "brumbies" (wild horses) on stock holdings in Queensland on certain conditions. The provisions, however, only apply to such portions of the State as are proclaimed by the Governor in Council, and are limited to a period of not more than four months in any year.

A Proclamation has been passed declaring the Roma stock district to be a district in which the provisions relating to the destruction of "brumbies" shall apply, but such provisions shall apply in this district only for four months from the 1st June, 1931, to the 30th September, 1931. Destruction of "brumbies" may therefore be carried out in this district by stockowners at any time during the said four months provided that all formalities required by the Acts have first been observed.

School of Instruction for Pig Raisers.

Attention is called to the Annual School of Instruction for farmers interested in pig raising, to be held at the Queensland Agricultural High School and College, Gatton, during the period 22nd June to 3rd July, 1931. The schools have been organised to provide the means whereby farmers and their sons desirous of improving their knowledge of pig raising may come together at a convenient centre for the purpose of meeting one another and of attending practical demonstrations and lectures and indoor studies on every phase of pig raising.

As early application is essential, it will be necessary for those interested to get in touch with the Principal of the college so that arrangements may be made in ample time before the date the school opens. The social side of the life of these schools is a special feature. Before the evening lecture session begins, opportunity is afforded for a free-and-easy hour for questions and answers, during which questions relative to any branch of agriculture may be asked. At these sessions officers attend who are interested with other branches of college activities. In fact, question time is one of the most interesting periods of the day for those interested in general agriculture and dairying, as well as pig raising. The evening cinematograph and lantern lectures are also of much interest and value, and are always appreciated.

An added attraction in the school programme is the visit of inspection to bacon factories while in operation.

The school fees are exceptionally reasonable (£3 9s. 6d. for the fortnight), and cover all expenses, including board and residence. Concession fares on the railways are available to those attending on presentation of certificates signed by the college officials. Further particulars may be obtained by communicating with the Principal, Queensland Agricultural High School and College, T.P.O. South ('phone Gatton 1), or from the Department of Agriculture and Stock, Brisbane ('phone B 1544). No time should be lost, as applications must be lodged not later than 8th June, 1931.

At the college piggery more than 300 pigs are kept. These comprise representatives of the several breeds in Queensland, and they are bred for stud purposes as well as for the production of pork and bacon. An extensive series of experiments in the breeding of pigs is in operation. These experiments are under the control of the Departments of Public Instruction and Agriculture and Stock and of the Queensland Pig Industry Committee. The results of cross-breeding, and this section, should be of much interest to those attending the school. Lecturettes will be given to indicate just what is being done. The objective is to test, under farm conditions, prolificacy, suitability, early maturity, and economy of production of various types of pigs.

It is hoped that visits of inspection will also be paid to the Stock Experiment Station, Yeerongpilly, where a number of experiments are in operation, and to the Department of Agriculture and Stock, Brisbane. Post application in letter form immediately to the Principal at address mentioned.

Removal of Citrus Plants from the Burrum District Prohibited.

The Instructor in Fruit Culture at Nambour, in a report to the Director of Fruit Culture on the citrus crop in the Burrum district, stated that brown spot of mandarins was spreading throughout the district, and the disease was becoming a serious menace to the industry.

In order, therefore, to combat the further spread of the disease, a Proclamation has to-day been issued prohibiting the removal of all citrus plants from the Burrum district to any other part of Queensland.

The Acting Minister for Agriculture (Hon. Reg. M. King) has approved of the levying of an assessment of 1d. per ton on all sugar cane received at the Invicta sugar works during the season 1931-32. Last year the assessment was 2d. per ton.

Royal National Show, 1931.

The organisation of the Royal National Show, to be held in Brisbane, 10th to 15th August, is already well advanced, and prize schedules are now available for distribution. Anyone interested may write in to the Secretary of the Royal National Association, Courier Building, for a copy of this publication, and should state the section in which they are interested in order that the correct entry form may be sent. The Council of the Association are determined to maintain the high standard of Queensland's Royal Show, particularly in this time of national crisis, when it is, perhaps, more desirable than ever that the people of this great Commonwealth should realise the tremendous resources and potentialities of the country in which we live. A large sum of money has already been set aside for further ground improvements at Bowen Park, and it will be utilised for the benefit of show patrons in augmenting the comforts and appointments already in existence. Approximately £10,000 is again made available by way of prize money in the various sections of the show. Last year the Southern Press and many prominent interstate visitors and breeders were pleased to describe our Dairy Cattle Section as the finest in the Commonwealth, and the prospects for the 1931 Show bid fair to eclipse last year's effort.

Queensland holds the foremost position in the butter industry of Australia, and this has only been made possible by the shrewd foresight of the dairymen of the State in having effectively improved their herds from a production standpoint. Much leeway has been made up in the past two years by way of increased production; indeed, the effect of the sustained price collapse in London, though disconcerting at the outset, has been largely minimised by this means. The modern appointments in the rearranged Poultry Pavilion were made available for the first time at the 1930 Show, and the 2,000-odd exhibits housed there constituted a wonderful display of the feathered world. Interstate representation in this section at the forthcoming show promises to be heavy, with the result that competition will be keener than ever.

Angora rabbit owners are advised that a special non-competitive section has been provided for exhibits under this heading, the entry fee for which is 5s., members half rates.

In the Pig Section, additional classes have been provided for Wessex Saddlebacks, and also pens of export porkers and baconers. The latter should prove to be of immense educational value.

Exhibitors can assist in the heavy work of organisation by forwarding their entries early. The final closing date is 6th July.

The Royal Society of Queensland.

The Ordinary Monthly Meeting was held in the Geology Lecture Theatre of the University on Monday, 27th April, at 8 p.m. The President, Dr. D. A. Herbert, was in the chair, and about thirty members and visitors present. The following were unanimously elected members of the Society:—Miss J. Cue, B.Sc., Messrs. W. Kyle, M.A., W. McDougall, B.Sc., F. C. Bennett, B.Sc., W. L. Payne, J Brigden, M.A., and Dr. Reye. The following were proposed for ordinary membership:—Miss E. Duncan, B.Sc., Dr. J. G. Drew, and Mr. N. Fisher, B.Sc.

Dr. W. H. Bryan exhibited an interesting basaltic agglomerate from the hill known as Mount Tarampa, in the Lockyer Valley, near Tarampa.

This exhibit was commented on by Mr. Tryon.

Mr. H. A. Longman exhibited a specimen of *Demansia guttata* Parker, which had been sent to the Queensland Museum by Mr. A. McLeod, Hazelwood, Longreach. This species was described from two specimens collected at Winton by Captain (now Sir Hubert) Wilkins for the British Museum. The snake exhibited was the

third to be recorded. Comments were made on this exhibit by Dr. Marks and Mr. Tryon.

The President extended a hearty welcome to Mr. Francis, the Hon. Librarian of the Society, on his return from Europe. Mr. Francis gave an account of his trip abroad, describing the different herbaria in which he had worked, and the botanists with whom he came in contact.

Mr. White read a paper entitled "Two Previously Undescribed Queensland Myrtaceae."

The paper describes two new species of Myrtles from Queensland. The first of these is *Darwinia Porteri*, first collected by Mr. George Porter on rocky hills near Watsonville, North Queensland. The genus is an interesting one as it is confined to Australia, most of the species being natives of Western Australia. The genus commemorates the famous naturalist, Charles Darwin, and was previously only represented in Queensland by one species. It is a pretty little shrub with red and yellow flowers and when placed in water retains its freshness for quite a long time.

The second plant is a new species of Tea Tree or Melaleuca collected at Traverston at the mouth of the Burrum River by the author, and it has been named *Melaleuca Cheelii* after Mr. Cheel of the Botanic Gardens, Sydney, in recognition of his work on this genus of plants.

This paper was commented on by the President.

Professor Hawken then took the chair, and the President, Dr. D. A. Herbert, read a paper entitled "The Movements of *Neptunia gracilis*, a Native Sensitive Plant."

Neptunia gracilis is a native sensitive plant whose leaves close rapidly when touched or wounded, reopening slowly until in ten or fifteen minutes they are again in their normal position. At night they close, but to a greater extent than they do when wounded. In a wounded leaf the stimulus is transmitted along the leaf, and also slowly across the axis to opposite leaflets, and not along the axis and back down the other side.

An extract of Neptunia leaves produces a normal response in those of the American sensitive plants, *Mimosa pudica* and *Mimosa Spegazzinii*, but curiously does not produce any movement in the leaves of Neptunia itself. Extracts of a native species of wattle, *Acacia podalyriaefolia*, and of various other leguminous plants, were found to act as a stimulant in the same way, so that the property of producing a stimulant is not restricted to plants such as Mimosa and Neptunia, which show rapid movement. Non-leguminous sensitive plants such as Averhoa do not respond to the substance.

This paper was discussed by Messrs. Hines, Tryon, Longman, Dr. Marks and Professor Hawken. Professor Richards moved a vote of thanks to Mr. White and Dr. Herbert, which was carried by acclamation.

Strawberry Marketing.

His Excellency the Governor has approved of the issue of a Regulation, under "*The Fruit Marketing Organisation Acts, 1923 to 1930*," providing for a ballot to be taken of strawberry growers that an Order in Council be issued declaring that strawberries produced in Queensland for a period of twelve months from the 15th June, 1931, to the 14th June, 1932, shall be acquired by the Committee of Direction of Fruit Marketing as the owners thereof.

The ballot will be conducted by the Committee of Direction. The growers concerned shall comprise all growers of strawberries in Queensland who have strawberries growing in the State for market at the date of such declaration.

The Committee of Direction shall prepare a roll of growers; such roll shall be compiled from records of the Committee and such other sources of information as the Committee shall decide, and also by inserting the name of any grower who satisfies the Committee that he is a grower concerned. Such roll shall be conclusive evidence as to what persons are entitled to vote at the taking of the poll.

The Committee of Direction shall transmit, by prepaid letter post, to all persons whose names appear on the roll, a ballot-paper, and such other explanatory matter as the Committee of Direction shall decide, with a reply-paid envelope for the return of the ballot-paper. Growers shall complete the ballot-papers and return to the Committee of Direction not later than 5th June, 1931. Any ballot-paper which is not in order shall not be counted.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staff of the Queensland Baby Clinics, dealing with the welfare and care of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable cases of infant mortality.

BREAD.

FOOD is the source of all human energy, and most of this energy is derived from starch. The chief starch-containing foods are wheat, rye, barley, oats, rice, maize, potatoes, sago, tapioca, arrowroot. Of these wheat flour is the main energy-producing food of our race, and its relative importance has increased during the last century. The invention of the modern steel-faced plough in 1840 transformed the vast prairies of America, Russia, Australia, and other countries into wheat fields. In 1879—that is, scarcely more than fifty years ago—the invention of the modern roller-mill process of milling wheat transformed our flour into a product extremely suitable for commercial purposes, as it kept well and could be safely carried across the world. This process, unfortunately, deprived the flour of some of its nutritive value, but its product acquired a pure white colour very attractive to the human eye. The portions removed from the wheat consist of the outer coat and the embryo of the future plant. These are contemptuously termed "offals," and are fed to fowls and other animals. The most important loss is that of vitamin B. White bread differs from wholemeal bread by the absence of this vitamin. Consequently those whose food consists largely of white bread must obtain this vitamin from some other source, or they will lose health, fail to develop strong bodies, and fall easy victims to infectious diseases. Of late years, preparations of the parts of the wheat grain rejected after milling have been placed on the market in the form of preparations of bran and of wheat embryo (under the trade name "Bemax"). By their use we can add to our food the vitamin that has been taken out of it, and this is necessary for those who live chiefly on bread and butter.

"Not by Bread alone."

Bread contains, besides starch, a considerable proportion of proteids, but not such as will by themselves satisfy the needs of the human body. On bread alone, even wholemeal bread, it would be impossible to live in health. It would be equally impossible to live on bread and butter. On wholemeal bread and milk it might be possible to live indefinitely, and such a diet is well suited for invalids. The delusion that it is possible to live on a diet of bread, butter, meat, potatoes, sugar, and tea is responsible for an immense amount of ill-health. Only by the addition to such a diet of a liberal allowance of green vegetables or of milk, or of both combined, can we live healthy lives. This is not to deny that bread is a wholesome food, but it is not a complete food. A liberal allowance of other foods in addition is necessary for really good health. This is true of all forms of bread, or other foods made from flour, but if white flour is used it is of special importance to supply the deficiency of vitamin B. Bread can be partly replaced by other starchy foods. It is as unnecessary to eat bread with potatoes as butter with fat bacon, or sugar with golden syrup.

Dental Decay.

As a food bread has one great drawback, and that is its tendency to cause decay of the teeth. The ancient Egyptians, who were perhaps the first to grow cereals extensively, were the first of ancient peoples to suffer extensively from bad teeth. With modern white roller flour the effects are still worse, not only from bread but from cakes and biscuits. The child who is fed with bread and butter or biscuits between meals is almost sure to have decayed teeth before he goes to school, as is at present the fate of nine-tenths of our children. His teeth are never free from starchy particles, which go sour and cause decay. It is a safe rule never to feed children between meals, or at least to give them nothing but milk and fruit in the intervals.

The Craze for Soft Foods.

There is at present a craze for soft foods, and so we eat soft bread and butter, often rejecting the crusts. For this there is some excuse. Crisp crusts are nice, but the modern crust is often soft and tough and not nice at all. The nicest way to eat bread is first to cut it into slices and then bake them in the oven until hard and crisp right through. And yet we never see this baked bread in the home; the only place where we see it on the table is in men's clubs. Is this fashion of eating soft bread merely a habit, or is it because our women have such bad teeth that they are afraid of anything hard? For want of anything hard to bite many children have poorly developed jaws and teeth.

Safeguards.

In order to protect their teeth children should have a little acid jam with their bread and butter, or a lemon drink, or a little fruit at the end of a meal. These excite a free flow of saliva and help to cleanse the teeth. The use of a toothbrush after meals or at least after the evening meal is also a safeguard, if it is used properly.

ROSES.

A QUEENSLAND CATALOGUE.

From the Pacific Nurseries, Wondai road, Manly, near Brisbane, has come a comprehensive catalogue of new roses and a complete list of all the old favourites. Products of these well-known nurseries grace most of our gardens, and anyone extending his rose beds or planning new plots could not do better than follow the sound advice contained in this catalogue and obtain their stocks from acknowledged specialists in rose culture. Mr. C. W. Heers, the proprietor of the nurseries, advises that only the best quality of plants, true to name and type, are sent out. They are all young and worked on short stems, besides being hard pruned (branch and root) so as to ensure correct growth in their permanent positions.

From the catalogue, the following interesting points are taken:—

Time for Planting.

From June until the end of September. For the coastal, excepting perhaps the far North, we specially recommend the later period and, in support, advance the following reasons:—

(1) Every horticulturist must admit that all roses invariably exhibit luxurious and succulent growth and wealth of bloom during the months of March, April, May, and early June. This being so, we contend that as the plants are full of flowing sap they are not in a fit condition for transplanting during that period.

(2) Roses planted during the earlier months readily respond to the warm periods which assuredly occur in the middle of our winter, only to be as surely struck by our colder and more frosty days during the latter part of the winter. This shock not only checks the growth, but actually kills the tender, white, jelly-like roots then in the forming. There can be only one result—a plant with stunted growth upon which the foundation of your future tree has to be built. Remember, if these plants are left undisturbed in the nursery they remain dormant.

(3) On the other hand, a thoroughly rested and ripened plant, transplanted during late July, August, or September, according to the trend of the season, is ready to break away into full and vigorous growth as the warmth of spring appears, never to look back.

We readily admit that the rose, being a hardy plant, may even do well when planted early, but after much experience we prefer to pin our faith to late planting in most parts of Queensland, where our winter is so variable. Holding these views, we hope clients will not ask us to send roses out earlier than June, although we much prefer, whenever convenient, that you follow our advice and plant later in the season, say from the middle of July to the middle of September.

It is gratifying to us to know that quite a number of clients after acting upon our advice, write to say how pleased they are with their experience of late planting; so we reiterate—do not plant or prune roses too early in Queensland, especially along eastern slopes.

Roses should never be planted when the ground is sodden, as the soil glues together and excludes the air so necessary for the future welfare of the plant. Rather delay planting, and in the meantime bury the whole plant lengthwise, cover completely with soil and await more favourable conditions.

Planting.

Although roses do well under almost any conditions it will always repay you to trench and drain the ground. However, should the ground be flat and unsuitable for drainage, it is better to dig it a foot deep and raise the bed. Such beds require hardwood or concrete borders, otherwise the outside plants dry out too easily. Work in a liberal supply of well-rotted cow or stable manure. This work should be done at least four weeks prior to planting. Plant so that the union will be just under the surface of the ground. In the case of light, sandy soils it is an advantage to have the union as much as 2 inches below the surface. Never, on any account place fresh manure or any form of fertilizer near the roots at the time of planting.

The roots should be evenly spread and so arranged as to give them a downward tendency; cover with about 3 inches of fine soil, and press down firmly; fill in and give a liberal supply of clean water. Keep the earth away from the graft until the plant strikes; in the meantime mulch with straw in order to protect union and keep the soil from caking.

The mulch also creates an ideal condition for further waterings. Should the weather continue dry, it will be necessary to water at intervals, according to the conditions. Do not use fresh manure or artificial fertilizer near the roots when planting. Should the sun's rays become hot after planting, it is advisable to provide the plant with artificial shade.

Suckers.

Always keep a sharp lookout for briar suckers, which may from time to time sprout from below the graft. These are readily detected by their foliage, and if not removed they will, in time, kill the rose tree.

Manuring.

Roses should be heavily manured at least once a year, well-rotted animal manure being the best. It should be spread over the bed and lightly forked in. Bone dust and other suitable fertilizers are also beneficial. Established rose trees are greedy feeders, and periodical light dressings of fertilizer, applied during damp weather, give good results. Heavy soils need occasional dressings of lime, which, however, should not be used within a month or so of fertilizers.

Pruning.

There is no phase of rose culture more difficult to impart than that of pruning. After accepting the broad principles generally laid down, make a close study of the habits and peculiarities of the various types of roses. Apply common sense methods, and observe and profit by the results obtained. We are opposed to early pruning in this State for similar reasons to those advanced against early planting. However, varieties with H.P. strain may, if the canes are sufficiently ripened, be shortened during March or April to from 3 to 5 feet from the ground—the weaker the shorter. This will ensure a wealth of bloom in the late autumn. For the annual overhaul the end of July and August is the best time. Hard pruning, as practised in cold countries, must not be generally applied here. The reason is not far to seek, as the periods of inactivity are short and uncertain. Make the prevailing conditions your guide as to how and when to prune. Assist the pruning problem by observing the following golden rules during the entire season:—(1) Cut away dead, spindled wood; (2) always cut blooms and stems that have bloomed well back to a strong eye; (3) never allow seed pods to form on the bush. By these means you will encourage correct growth and freedom of bloom. There are odd varieties which resent the knife.

It is most important that plants be kept free from scale and other diseases, otherwise valuable portions have to be prematurely removed, to the detriment of the plant. Exhibitors should prune harder than those growing for general purposes. Tea roses require lighter treatment than H.T.'s and H.P.'s.

To prune, cut away all dead, diseased and spindling wood; thin out anything that is liable to crowd; cut back shoots to a strong eye, pointing outward in the case of uprights and inward on those of spreading habits; preserve any new, strong shoots coming from the base (often misnamed water shoots) that may serve to replace any worn-out stems that should be renewed every three years or so.

As soon as the new growth appears, carefully rub off any shoot that is likely to overcrowd or grow in a wrong direction.

Climbers should be allowed their fling during the time they are establishing themselves. Train the strongest canes horizontally, about 18 inches apart, shorten the ends, and cut away all other wood. Provide for the renewal of these trailers every couple of years or so.

Aphis.

Nicotine sprays, such as Black Leaf Forty, are most effective. They may be kept in check by applying the hose freely.

Scale.

Spray with either red oil, kerosene, emulsion, or any lime-sulphur mixture. Many roses are lost annually through scale.

Grubs.

For all leaf, plant, and flower-eating insects, spray with arsenate of lead, as directed.

Mildew.

This is a stubborn fungus disease that has for many years past baffled our scientists. The rose, like all other life, no doubt requires a properly balanced food, and as analyses show that our soils are often deficient in potash and lime, it is not altogether surprising to find that, where good dressings of wood ashes have been applied, appreciable improvement in reducing the mildew scourge is apparent. Experiments are being conducted all over the world in search of a cure for mildew, and reports to hand show that potash used in its various forms gives results which are at least reassuring. For our part we can say that we have found the use of wood ashes, also spent carbide, beneficial. If these are not available, try giving each established tree say 4 to 6 oz. of sulphate of potash, in addition to lime, and observe the result.

Regular sprayings with liver of sulphur (1 oz. to 2 gallons of water), or 1 oz. bicarbonate of soda to 1 gallon of water, or Bordeaux, will ward off attacks. Remedies: Flowers of sulphur, 9 parts; arsenate of lead, 1 part; well mixed; applied with a bellows when dew is on the foliage. Sprays: Sulphuric acid, 1 part to 800 parts of rain water. One ounce bicarbonate of soda to 1 gallon of rain water is a helpful spray. A drastic remedy is 2 tablespoonfuls lysol to 1 gallon of water. Sprayings should be done before noon. Always treat the underneath as well as the top of the foliage.

Failures are generally attributable to one or more of the following causes:—

Having used fresh manures or fertilizer at time of planting. Allowing roots to be exposed after unwrapping. Lack of drainage or planting in soggy ground through excessive wet weather. Planting too near the edge of raised beds, too near shrubs, trees, and/or hedges; also in shady positions. Allowing plants to dry out after westerlies. Giving too much water during first fourteen days. Heavy frosts just after planting or even when the plant is established. Planting too deep, planting too shallow, or planting too loose. Acidity in damp or poorly prepared soils. Chemical reactions from fertilisers previously applied to the soil. Plants being knocked by children or the thoughtless gardener. Dogs and cats are often the cause of plants dying or being damaged. The use of strong soap suds, &c. Planting too early or too late. Planting in same spot where a rose has been growing unless soil has been replaced.

FLOWER GARDEN.

Winter work ought to be in an advanced state. The roses will not want looking after. They should already have been pruned, and now any shoots which have a tendency to grow in wrong directions should be rubbed off. Overhaul the ferneries, and top-dress with a mixture of sandy loam and leaf mould, staking up some plants and thinning out others. Treat all classes of plants in the same manner as the roses where undesirable shoots appear. All such work as trimming lawns, digging beds, pruning, and planting should now be got well in hand. Plant out antirrhinums, pansies, hollyhocks, verbenas, petunias, &c., which were lately sown. Sow zinnias, amaranthus, balsam, chrysanthemum tricolour, marigold, cosmos, cockscombs, phloxes, sweet peas, lupins, &c. Plant gladiolus, tuberoses, amaryllis, pancratium, ismene, crinums, belladonna lily, and other bulbs. Put away dahlia roots in some warm moist spot, where they will start gently and be ready for planting out in August and September.

THE CARE OF THE LAWN.

For a lawn to be a success it must be carefully made in the first place. Good drainage is essential, for stagnant water-logged soil encourages weeds and kills the grass. The soil should be rich in plant food. Give the ground a heavy dressing of good manure, and thoroughly dig it over. Enough time should then be allowed for the soil to settle, as it must be firm when the grass is planted or there will be a series of hills and hollows shortly after. In addition to the manure apply the following mixture at the rate of 3 oz. to the square yard, forking or raking it well into the top spit of the soil:—2 lb. superphosphate of lime, 1 lb. bonemeal, and 1 lb. sulphate of ammonia.

Early in the spring, as the grass begins to grow, a heavy roller should be passed several times over the ground.

Lawns showing bare patches will require a dressing during the autumn, and the mixture previously mentioned will be found very suitable, and will keep the grass well nourished. Wood ashes and soot, combined or not, will also be found beneficial. All dressings should be applied during showery weather. If soil poverty is the cause of a patchy lawn, it is best to rake over in the autumn with a sharp-toothed rake, and dress with a good layer of fine soil and wood ashes.

KITCHEN GARDEN.

Should showery weather be frequent during July, do not attempt to sow seeds on heavy land, as the latter will be liable to clog, and hence be injurious to the young plants as they come up. The soil should not be reworked until fine weather has lasted sufficiently long to make it friable. In fine weather get the ground ploughed or dug, and let it lie in the rough until required. If harrowed and pulverised before that time, the soil is deprived of the sweetening influences of the sun, rain, air, and frost. When the ground has been properly prepared, make full sowings of cabbage, carrot, broad beans, lettuce, parsnips, beans, radishes, leeks, spring onions, beetroot, eschalots, salsify, &c. As westerly winds may be expected, plenty of hoeing and watering will be required to ensure good crops. Pinch the tops of broad beans which are in flower and stake up peas which require support. Plant out rhubarb, asparagus, and artichokes. In warm districts it will be quite safe to sow cucumbers, marrows, squashes, and melons during the last week of the month. In colder localities it is better to wait till the middle or end of August. Get the ground ready for sowing French beans and other spring crops.

Rhubarb.

The continued production of rhubarb may be greatly assisted by giving a heavy mulching of manure and hoeing it well into the soil. Keep the beds well watered, and give regularly a dressing of liquid manure, say, once a week.

It is not necessary to use forcing manures on the young stock, as plants are ruined if forced in the early stages of growth.

The rhubarb makes rapid growth during the autumn and spring, and when stalk cutting has been started liquid manuring and manuring may be given.

Orchard Notes for July.

THE COASTAL DISTRICTS.

The marketing of citrus fruits will continue to occupy the attention of growers. The same care in the handling, grading, and packing of the fruit that has been so strongly insisted upon in these monthly notes must be continued if satisfactory returns are to be expected. Despite the advice that has been given over and over again, some growers still fail to grasp the importance of placing their fruit on the market in the best possible condition, and persist in marketing it ungraded; good, blemished, and inferior fruit being met with in the same case. This, to say the least, is very bad business, and as some growers will not take the necessary trouble to grade and pack properly, there is only one thing to do, and that is to insist on the observance of standards of quality and see that the fruit offered for sale complies with the standards prescribed, and that cases are marked accordingly.

Where the crop has been gathered, the trees may be given such winter pruning as may be necessary, such as the removal of broken or diseased limbs or branches, and the pruning of any superfluous wood from the centre of the tree. Where gumming of any kind is seen it should be at once attended to. If at the collar of the tree and attacking the main roots, the earth should be removed from around the trunk and main roots—all diseased wood, bark, and roots should be cut away, and the whole of the exposed parts painted with Bordeaux paste.

When treated do not fill in the soil around the main roots, but allow them to be exposed to the air for some time, as this tends to check any further gumming. When the gum is on the trunk or main limbs of the tree cut away all diseased bark and wood till a healthy growth is met with, and cover the wounds with Bordeaux paste.

If the main limbs are infested with scale insects or attacked by any kind of moss, lichen, or fungus growth, they should be sprayed with lime sulphur.

Towards the end of the month all young trees should be carefully examined for the presence of elephant beetles, which, in addition to eating the leaves and young bark, lay their eggs in the fork of the tree. When the young hatch out they eat their way through to the wood and then work between the wood and the bark, eventually ringbarking one or more of the main limbs, or even the trunk. A dressing of strong lime sulphur to the trunk and fork of the tree, if applied before the beetles lay their eggs, will act as a preventive. In the warmer localities a careful watch should also be kept for the first appearance of any sucking bugs, and to destroy any that may be found. If this is done systematically by all growers the damage done by this pest will be very much reduced.

Citrus trees may be planted throughout the month. Take care to see that the work is done in accordance with the instructions given in the June notes. All worn-out trees should be taken out, provided the root system is too far gone to be renovated; but when the root system is still good the top of the tree should be removed till sound, healthy wood is met with, and the portion left should be painted with a strong solution of lime sulphur. If this is done the tree will make a clean, healthy growth in spring.

The inclusion of a wide range of varieties in citrus orchards—and which has been the general practice—is to be deprecated. Even in new plantations there is a tendency to follow the same unprofitable lines. Far too much consideration is given to the vendor's description or the purchaser's appreciation of a particular variety or varieties. Individual tastes must be subordinated to market requirements, and the selection of varieties to the best available kind of early, medium, and late fruits. Amongst oranges Joppa should be placed first, Sabina for early fruit, and Valencia or Loon Giru Gong for late markets.

In mandarins local conditions influence several varieties, and since the introduction of the fungus known as "scab" the inclusion, particularly on volcanic soil, of the Glen Retreat and Emperor types is risky. In alluvial lands, Emperor and Sovereign (an improved Glen Retreat) are the most profitable, though Scarlet in many places is worth including, with King of Siam as a late fruit.

Land intended for bananas and pineapples may be got ready, and existing plantations should be kept in a well-cultivated condition so as to retain moisture in the soil.

Bananas intended for Southern markets may be allowed to become fully developed, but not coloured, as they carry well during the colder months of the year, unless they meet with a very cold spell when passing through the New England district of New South Wales.

The winter crop of smoothleaf pines will commence to ripen towards the end of the month, and when free from blackheart (the result of a cold winter) or from fruitlet core rot, they are good for canning, as they are of firm texture and stand handling. Where there is any danger of frost or even of cold winds, it pays to cover pines and also the bunches of bananas. Bush hay is used for the former and sacking for the latter.

Strawberries should be plentiful during the month, provided the weather is suitable to their development, but if there is an insufficient rainfall, then irrigation is required to produce a crop. Strawberries, like all other fruits, pay well for careful handling, grading, and packing; well-packed boxes always realising a much higher price than indifferently packed ones on the local market. Where strawberries show signs of leaf blight or mildew, spray with Bordeaux mixture for the former and with sulphide of soda for the latter.

When custard apples fail to ripen when gathered, try the effect of placing them in the banana-ripening rooms, and they will soon soften instead of turning black.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

July is a busy month for the growers of deciduous fruits, as the important work of winter pruning should, if possible, be completed before the end of the month, so as to give plenty of time for spraying and getting the orchard into proper trim before the spring growth starts.

In pruning, follow the advice given in the May number; and if you are not thoroughly conversant with the work, get the advice of one of the Departmental officers stationed in the district.

Pruning is one of the most important orchard operations, as the following and succeeding seasons' crops depend very largely on the manner in which it is carried out. It regulates the growth as well as the number and size of the fruit, as if too much bearing wood is left, there is a chance of the tree setting many more fruits than it can properly mature, with a result that unless it is rigorously thinned out it is undersized and unsaleable. On the other hand, it is not advisable to unduly reduce the quantity of bearing wood, or a small crop of overgrown fruit may be the result.

Apples, pears, and European varieties of plums produce their fruits on spurs that are formed on wood of two-years' growth or more; apricots and Japanese plums on new growth and on spurs; but peaches and nectarines always on wood of the previous season's growth. Once peachwood has fruited it will not produce any more from the same season's wood, though it may develop spurs having a new growth or new laterals which will produce fruit.

The pruning of the peaches and nectarines, therefore, necessitates the leaving of sufficient new wood on the tree each season to carry a full crop, as well as the leaving of buds from which to grow new wood for the succeeding year's crop. In other words, one not only prunes for the immediately succeeding crop, but also for that of the following season.

All prunings should be gathered and burnt, as any disease that may be on the wood is thoroughly destroyed. When pruned, the trees are ready for their winter spraying with lime sulphur.

All kinds of deciduous trees may be planted during the month provided the ground is in a proper state to plant them. If not, it is better to delay planting until August, and carry out the necessary work in the interval. The preparation of new land for planting may be continued, although it is somewhat late in the season, as new land is always the better for being given a chance to mellow and sweeten before being planted. Do not prune vines yet on the Granite Belt; they can, however, be pruned on the Downs and in the western districts.

Trees of all kinds, including citrus, can also be planted in suitable situations on the Downs and western districts, and the pruning of deciduous trees should be concluded there. If the winter has been very dry, and the soil is badly in need of moisture, all orchards in the western districts, after being pruned and ploughed, should receive a thorough irrigation (where water is available) about the end of the month, so as to provide moisture for the use of the trees when they start growth. Irrigation should be followed by a thorough cultivation of the land to conserve the water so applied. As frequently mentioned in these notes, irrigation and cultivation must go hand in hand if the best results are to be obtained, especially in our hot and dry districts.

Farm Notes for July.

FIELD.—Practically the whole of the work on the land for this month will be confined to the cultivation of winter crops, which should be now making good growth, and to the preparation of land for the large variety of crops which can be sown next month. Early-maturing varieties of wheat may be sown this month. The harvesting of late-sown maize will be nearing completion, and all old stalks should be ploughed in and allowed to rot. Clean up all headlands of weeds and rubbish, and for this purpose nothing equals a good fire. Mangels, swedes, and other root crops should be now well away, and should be ready for thinning out. Frosts, which can be expected almost for a certainty this month, will do much towards ridding the land of insect pests and checking weed growth. Cotton-picking should be now practically finished and the land under preparation for the next crop. The young lucerne should be becoming well established; the first cutting should be made before the plants flower—in fact, as soon as they are strong enough to stand the mowing machine—and the cutting of subsequent crops should be as frequent as the growth and development of the lucerne plants permit. Ordinarily cutting should be regulated to fit in with the early-flowering period—i.e., when about one-third of the plants in the crop are in flower.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	June, 1931.		July, 1931.		MOONRISE. June, 1931.	MOONRISE. July, 1931.
Date	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6.39	5.0	6.48	5.3	5.25	6.9
2	6.39	5.0	6.48	5.3	6.23	7.7
3	6.40	5.0	6.48	5.3	7.22	8.4
4	6.40	5.0	6.48	5.3	8.21	9.3
5	6.40	5.0	6.48	5.4	9.19	9.55
6	6.41	4.59	6.48	5.4	10.17	10.50
7	6.42	4.59	6.48	5.4	11.11	11.37
8	6.42	4.59	6.48	5.4	...	...
					a.m.	a.m.
9	6.42	4.59	6.47	5.5	12.3	12.29
10	6.43	4.59	6.47	5.5	12.57	1.24
11	6.43	4.59	6.47	5.6	1.48	2.22
12	6.43	4.59	6.47	5.7	2.40	3.22
13	6.43	4.59	6.46	5.7	3.35	4.22
14	6.44	5.0	6.46	5.8	4.36	5.22
15	6.44	5.0	6.46	5.9	5.36	6.23
16	6.44	5.0	6.46	5.9	6.37	7.19
17	6.45	5.0	6.45	5.10	7.38	8.8
18	6.45	5.0	6.45	5.10	8.36	8.50
19	6.45	5.0	6.45	5.11	9.28	9.25
20	6.46	5.0	6.44	5.11	10.14	9.59
21	6.46	5.0	6.44	5.12	10.49	10.32
22	6.46	5.0	6.44	5.12	11.25	11.5
23	6.46	5.0	6.43	5.13	11.58	11.43
					p.m.	p.m.
24	6.47	5.1	6.43	5.13	12.31	12.22
25	6.47	5.1	6.42	5.14	1.6	1.9
26	6.47	5.1	6.42	5.14	1.43	2.3
27	6.47	5.2	6.41	5.15	2.25	3.1
28	6.47	5.2	6.41	5.15	3.14	3.58
29	6.47	5.3	6.40	5.16	4.11	4.56
30	6.47	5.3	6.40	5.16	5.9	5.46
31	...	...	6.39	5.17	...	6.39

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

Phases of the Moon, Occultations, &c.

1 June	○	Full Moon	12 33 a.m.
8 „	☽	Last Quarter	4 18 p.m.
16 „	●	New Moon	1 1 p.m.
23 „	☾	First Quarter	10 23 a.m.
30 „	○	Full Moon	10 46 a.m.

Perigee, 9th June, at 5.54 a.m.
Apogee, 22nd June, at 11 a.m.

The occultation of Tau Sagittarii, magnitude 3·5, will occur soon after 10 p.m. on the 30th, in the north-north-east, when the Moon will be full, but will require telescope or good binoculars. It should be an interesting object for general observers.

Mercury will rise at 4.42 a.m. on 1st June, at Warwick, and at 5.28 a.m. on the 15th.

Venus will rise at 4.34 a.m. on the 1st, and at 5.2 a.m. on the 15th.

Mars will rise at 11.41 a.m. and set at 11.34 p.m. on the 1st; on the 15th it will rise at 11.9 a.m. and set at 10.15 p.m.

Jupiter will set at 7.55 p.m. on the 1st, and at 7.13 p.m. on the 15th.

Saturn will rise at 8.7 p.m. on the 1st, and at 7.12 p.m. on the 15th.

The Southern Cross will be upright in the position corresponding to position XII. on the clock face at 8 p.m. on the 1st of June. It will reach position I. at 10 p.m., and position II. at midnight. As it will repeat these positions four minutes earlier on each night an observer can easily calculate its position for any time desired.

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8 July.	☽	Last Quarter	9 51 a.m.
15 „	●	New Moon	10 50 p.m.
22 „	☾	First Quarter	3 16 p.m.
29 „	○	Full Moon	10 47 p.m.

Apogee, 7th July, at 12.30 a.m.
Perigee, 18th July, at 10.24 p.m.

On July 1, at 8 p.m., Saturn will be about 6 degrees west of the full Moon; both in the constellation Sagittarius.

On the 6th, the earth will be 3 million miles further from the Sun than on January 3. Yet, strangely, it will be Summer time in England.

On the 9th, between 6 and 7 p.m., a glimpse of the planets Jupiter and Mercury, remarkably near to one another, may be obtained in the west-north-west—about 22 degrees north of west—very near the horizon.

On the 13th, the ringed planet Saturn will be exactly on the opposite side of the earth to the Sun. In consequence of this Saturn will rise as the Sun sets, and set when the Sun rises.

On the 18th, at 7 p.m., the planet Neptune may be looked for, with telescope or binoculars, 2 degrees southward of the Moon when nearing the western horizon.

Jupiter will be on the far side of its orbit, nearly in a line with the Sun on the 25th, when the Sun will be passing the planet from west to east. It will, of course, be lost to sight for several days before and after the conjunction.

Early in the evening on the 28th, when Saturn and the Moon come into view after 6 p.m., it will be noticeable that Saturn will be north-west of the Moon at a distance rather more than the length of the Southern Cross, the Moon having passed from west to east of Saturn four hours earlier.